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Faunal Exploitation at the Middle Paleolithic Site Kabazi II (Western Crimea)

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Abstract

Kabazi II is an open-air site situated within the second chain of the Crimean Mountains. Discovered in 1986, and intensively excavated from 1987 to the mid 1990's, Kabazi II served as a kill and butchery site for Neanderthal groups in the area. Previous faunal analyses at Kabazi II (Patou-Mathis 2003, 1999, 2005, 2006a, 2006b) indicate that the subsistence strategies of the Neanderthals at Kabazi II were highly specialized and were primarily focused on hunting small groups of *Equus hydruntinus* as well as occasional encounter-based hunting of other mammal species. This practice had apparently remained unchanged in spite of changes in lithic industry, climate, and local vegetation cover.

This study presents the analysis of previously unexamined faunal assemblages from Levels II/1, II/2-1, II/2, II/3, II/4, II/5, II/7, II/8, II/9, II/13, II/13A. The results obtained here concur with those of the previous analyses however differences in the use of Kabazi II have been observed and a possible link with the nearby rock-shelter, Kabazi V has been determined. It is believed that the persistence of the hunting practices of the Neanderthals at Kabazi II throughout its nearly 100 000 year sequence of occupations is due to the versatility of wild asses such as *Equus hydruntinus*, the geography and geology of the study area, in addition to characteristics of Kabazi II itself.

Key Words: Middle Paleolithic, Crimea, Neanderthal, subsistence behavior.

Résumé

Kabazi II est un site de plein air, situé sur la deuxième rangée des Monts de Crimée. Après sa découverte en 1986, les investigations archéologiques effectuées entre 1987 et le milieu des années 90 ont établi que Kabazi II avait auparavant servi de lieu de chasse et d'abattage pour les groupes néanderthaliens de la région. Les études archéozoologiques antérieures (Patou-Mathis 2003, 1999, 2005, 2006a, 2006b) ont déterminé que les stratégies de subsistance des Néanderthaliens du Kabazi II étaient très spécialisées et principalement axées sur la chasse des petits groupes de *Equus hydruntinus* mais aussi, à l'occasion, sur la chasse d'autres espèces. Ces comportements ont persisté malgré les changements climatiques et technologiques à travers l'histoire d'occupation du site.

Cette étude présente l'analyse des assemblages fauniques encore inédits des niveaux II/1, II/2-1, II/2, II/3, II/4, II/5, II/7, II/8, II/9, II/13, II/13A de Kabazi II. Nos résultats sont en accord avec ceux obtenus parles d'études antérieures ; cependant, des différences par rapport à la fonction du site ont été constatées et un lien possible avec Kabazi V, un abri sur roche tout près de Kabazi II, a été établi. On croit que la persistance des activités de subsistance des Néanderthaliens de Kabazi II pendant presque 100 000 ans de présence est due à la polyvalence des ânes asiatiques tels que *Equus hydruntinus,* au contexte géographique et géologique de la région ainsi qu'aux caractéristiques du site elles-mêmes.

Mots Clés: Paléolithique moyen, Crimée, Néanderthal, comportements de subsistance.

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I-Introduction

Over the past twenty years our understanding of Neanderthal subsistence systems has shifted from viewing them as inflexible and maladapted to being quite dynamic and varied over time and space. Some studies (cf. Binford 1984; Soffer 1989; Farizy & David 1992) suggest that Neanderthals were generally opportunists and scavengers. On the other hand, others (cf. Stiner 1991, 1994; Brugal 1999; Patou-Mathis 2006c) have demonstrated that Neanderthals were effective hunters who would resort to scavenging (possibly more than their modern human successors) in response to deteriorating conditions in their immediate environment.

It appears that Neanderthal populations were subject to several fundamental changes in climate over their roughly 200 000 year existence across Eurasia (Otte 1996; Richter 2006; Mellars 1996). These fluctuations drove their evolution, behavior, and distribution. However, climatic instability may have also contributed to their extinction (Otte 1996; Richter 2006; Mellars 1996, 2006; Hoffecker 2002). By the time Neanderthals disappear from the archaeological record at around 30 000 BP, they had effectively demonstrated their ability to adapt to periods of climatic adversity, however.

1.1-Neanderthal Origins and Distribution

The Neanderthal body type was not the product of rapid geographic specialization, rather, their features evolved slowly, over the course of several hundred thousand years of isolation. The genetic evidence suggests that the split between the lineages that gave rise to Neanderthals and Anatomically Modern Humans occurred during the early Middle Pleistocene at around 500 000 BP (Krings et al 1997; Tattersall 2006). In conjunction with the genetic evidence, the earliest appearance of the physical traits characteristic of the Neanderthals becomes visible on fossil crania from Southern and Western Europe between 500 000 and 300 000 BP. Such examples include Petralona (Greece), Arago (France), Swanscombe (England), Reilingen (Germany), and Sima de los Huesos (Northern Spain) (Otte 1996; Tattersall 2006; Mellars 1996).

By around 250 000 BP, the full suite of Neanderthal physical traits (for a description see Tattersall 2006, 10) becomes visible on such fossils as Ehringsdorf (Germany) and Biache-Saint-Vaast (France) (Tattersall 2006; Hoffecker 2002; Otte 1996; Mellars 1996). However, most of the Neanderthal fossil record dates to a period between 130 000 and 35 000 BP. The "full blown" emergence of Neanderthal physical traits is believed to represent an adaptive shift to a body type suited to inhabiting cold and dry regions, such as those witnessed during the Riss Glaciation (OIS 10 to 6) between 300 000 and 130 000 BP (Otte 1996; Tattersall 2006; Mellars 1996).

The climate becomes relatively warm around 130 000 BP. During the period between 130 000 and 71 000 BP (OIS sub-stages 5e to 5a), Neanderthal populations begin to expand eastwards (Hoffecker 2002; Richter 2006) and into the Levant. As time went on, the climate shifted towards colder and drier conditions. Between 71 000 and 55 000 BP (OIS 4) the number of Neanderthal sites diminishes substantially and most of Central Europe was abandoned (Mellars 1996; Otte 1996; Hoffecker 2002; Richter 2006). When the climate deteriorated in the Levant around 70 000 BP, Neanderthal populations persisted whilst modern humans were apparently pushed back to more southern latitudes (Henry 2003; Vandermeersch 1981).

The climate finally improves by around 55 000 BP (OIS 3) and Neanderthal populations recover temporarily. During OIS 3, Neanderthals begin to seasonally exploit different niches, such as higher altitudes, as evidenced by the number of sites that suddenly appear in the high mountain regions of the Alps and Caucasus (Richter 2006; Hoffecker & Cleighorn 2000). Furthermore, during this period the number of open-air sites increases in relation to the number of cave and rock-shelter sites (Mellars 1996, 2006; Richter 2006). However, the climate begins to deteriorate dramatically with the H4 event at 39 000 BP (Sepulchre et al. 2007). This event coincides more or less with the arrival of Anatomically Modern Humans in Europe. It is believed that the combination of climatic instability and resource competition led to the disappearance of the Neanderthals by about 30 000 BP (Mellars 2006, 1996).

1.2-Neanderthal Technology

In conjunction with the emergence of the suite of Neanderthal physical adaptations, their material culture also appears to undergo a dramatic adaptive shift. The earliest examples of prepared core techniques characteristic of the "Levallois" method date to around 280 000 BP at Mesvin (Belgium) and to 240 000 BP at Pontnewyd (Wales) (Otte 1992, 45). This type of core reduction is characteristic of Neanderthal tool production. One of the most impressive features of the Levallois technique is the variety of tools that can be produced in response to the demands of a given environment. This is demonstrated by the high degree in regional variability among Neanderthal tool assemblages in time and space (Otte 1992, 1996; Mellars 1996).

Two main industries associated with Neanderthals are recognized in Central and Eastern Europe- the Micoquian and the Mousterian (Mellars 1996; Otte 1996; Hoffecker 2002). Mousterian tools are largely based on prepared flakes (Otte 1996; Mellars 1996) whilst the Micoquian has a greater bifacial flaking index. The two industries are contemporaries, however, and their presence may be loosely tied to site function since 65% of Mousterian assemblages occur in cave sites, whereas 76% of Micoquian assemblages occur in both cave and rock shelter sites (Patou-Mathis 2000, 386). Trace analyses conducted on the working surfaces of Neanderthal tools demonstrate that they were largely employed in a variety wood working activities for the manufacture of implements used in hunting as well as hide preparation and butchery (Otte 1996; Hardy 1999).

The Levallois method remained the dominant technique of lithic reduction in Europe up until 40 000 to 35 000 BP, depending on the region (Otte 1992, 1996; Mellars 1996) after which modern humans begin to colonize the regions occupied by Neanderthals and "transitional" industries based on the blade and leaf point technology begin to appear. Examples of these include the Chatelperronian (Western Europe), Szeletian (Central and Eastern Europe) the Uluzzian (Italian Peninsula), and the Streletskaya and Spitsnkaya (Southern Russian Plain) (Otte 1996, 1992; Mellars 1996; Monigal 2004; Hoffecker 2002; Soffer 1989). It remains unclear whether or not these industries represent acculturation, imitation, or an independent evolution of Neanderthal tool manufacture.

1.3-Neanderthal Subsistence

Isotopic analysis of Neanderthal remains demonstrates that they were top carnivores in the same league as wolves and hyenas (cf. Bocherens et al 2005). Neanderthals preferentially preyed on a wide variety of mammal species, particularly large to medium-sized herbivores, regardless of the ecological niche they occupied. It has been suggested that they may have supplemented their diets with plant foods, marine resources, birds, and small mammals however evidence for this is generally lacking and inconsistent (Stiner 1994; Richter 2006; Patou-Mathis 2006c; Otte 1996). Nevertheless, it would appear that Neanderthals met their dietary demands through a combination of scavenging, opportunistic as well as specialized hunting (Stiner 1991, 1994; Burke 2000; Patou-Mathis 2006c, 2000; Mellars 1996; Otte 1996, 1992; David & Fosse 1999; Farizy & David 1992). Furthermore, Neanderthals exhibit a degree of behavioral plasticity across their geographic range in terms of acquisition strategies (i.e. hunting vs. scavenging) and prey species targeted (i.e., Stiner 1991, 1994; Chase 1986, 1988, 1989 - in Mellars 1996; Patou-Mathis 2000; Conard & Prindivill 2000) .

Analyses conducted on faunal assemblages from Combe Grenal (South-western France) demonstrate that patterns of species representation changed in response to climatic oscillations over the course of the 65 000 years that the site was occupied. Neanderthals apparently resorted to scavenging if food was scarce (Chase 1986, 1988, 1989-in Mellars 1996). The evidence from Combe Grenal suggests that the Neanderthals persisting in a given region by adapting their hunting tactics to exploit a wide variety of mammal species in response shifts in the local ecology.

Other examples of hunting-scavenging subsistence behaviors include the open-air site Mauran (France) where the faunal assemblage demonstrates that Neanderthals selectively hunted bison but at times would resort to scavenging. They targeted small herds of bachelor males as well as females with calves and solitary males, based on what was available during a particular hunting episode (Farizy & David 1992; Brugal 1999). In addition, analyses of faunal assemblages from Central Italy conducted by Stiner (1991, 1994) suggest that Neanderthal populations in the area relied on scavenging to supplement their diet. However, by 55 000 BP

(OIS 3) Neanderthals had become almost entirely reliant the selective hunting of prime aged adult animals. Furthermore, Patou-Mathis (2000) demonstrates that Neanderthals selectively hunted medium to large mammals based on age and sex in Western and Central Europe as early as 240 000 BP (OIS 7) and highly specialized, single species hunting appears in Eastern Europe as soon as Neanderthals begin to settle the region at around 125 000BP (OIS sub-stages 5e and 5d) (Patou-Mathis 2000, 2005; Hoffecker & Cleighorn 2000).

A synthesis of the data from Middle Paleolithic sites in Western Germany conducted by Conard and Prindivill (2000) demonstrates that Neanderthals actively hunted large and dangerous animals as rhinoceros, in addition to bovids and cervids. As at Combe Grenal, therefore, Neanderthals were capable of exploiting a wide variety of mammal species in response to climatic oscillations.

1.4-Neanderthals in Eastern Europe

Neanderthal populations represent the first hominids to successfully settle Eastern Europe, during the temperate climatic conditions associated with the Eemian Interglacial (i.e. OIS sub-stage 5e and 5d) that prevailed across most of Eurasia (Hoffecker 2002; Richter 2006; Gerasimenko 2005). The Crimean Peninsula has much to tell us about Neanderthal subsistence since it contains the largest concentration of Neanderthal sites in all of Eastern Europe (Hoffecker 2002; Chabai 1998a; Monigal 2004). The Crimea is also one of the few regions, like the Caucasus, Croatia, and Iberia where Neanderthals apparently persisted beyond 30 000 BP, at which point they are replaced by modern humans in the archaeological records of Western and Central Europe (Hoffecker 2002; Chabai & Marks 1998; Chabai 2008). It has been proposed that the success and persistence of Crimean Neanderthals is due to the fact that this region may have been a refugium for animals and by extension humans during periods of climatic instability (Chabai & Uthmeier 2006; Richter 2005; Chabai et al 2004; Monigal 2004).

Among the Crimean Neanderthal sites, the open-air locality Kabazi II has the highest potential of delivering new information regarding Neanderthal subsistence and its status over time since it contains the most complete record of Neanderthal occupations in all of Eastern

Europe. These occupations span the entire period from their first appearance during the Eemian Interglacial (OIS sub-stage 5d) at around 118 000 BP to their disappearance by beginning of the Late Plenniglacial (OIS 3/2) at around 27 000 BP (McKinney1998; Rink et al 1998; Chabai 2005).

Luckily, a large set of faunal remains recovered during the early excavations at Kabazi II is still unexamined. These derive from the faunal assemblages in Levels II/1, II/2-1, II/2, II/3, II/4, II/5, II/7, II/8, II/9, II/13 and II/13A, most of which are associated with the Mousterian industry of Western Crimea. The previously published analyses conducted by Patou-Mathis (2006a, 2006b, 2005, 2003, 1999) have concluded that over the course of its occupation, Kabazi II served as a kill and butchery site at which Neanderthals killed and processed small herds of the extinct wild ass species *Equus hydruntinus*. These earlier studies cover the assemblages associated with Micoquian and Mousterian occupations and would therefore serve to compliment the new results obtained from the analysis of this material.

The goal of this study is to examine subsistence practices of the Neanderthals at Kabazi II in terms of species representation, age and herd structure of the dominant fauna, seasonality, body region, and element representation, as well as detailed examination of the taphonomic effects and processes involved in assemblage formation. This new data will be compared with the previously published results of Patou-Mathis (2006a, 2006b, 2005, 2003, 1999) and will in turn be used to address the function of the site as well as note any changes over its extensive history of occupation. The role of Kabazi II within a regional settlement system will be addressed by comparison with data sets from the nearby rock-shelter of Kabazi V provided by Burke (1999) and Patou-Mathis (2007) in order to see how these sites articulate with one another, and finally, a discussion regarding the ethology of the mammal species represented in these assemblages will be presented in order to infer how the Neanderthals at Kabazi II may have hunted them.

II-The Study Area

2.1-The Geographic and Geologic Context of the Crimean Peninsula

The Crimean Peninsula is located in southern Ukraine along the northern coast of the Black Sea. The center of the peninsula is situated at approximately 45ºN, 34º 30'E; it is connected to the mainland by the Perekop Isthmus (Ferring 1998, 17). The eastern coast of the peninsula is bordered by the Sea of Azov the western and southern coasts are bordered by the Black Sea (Figure 2.1.1). The Crimean Peninsula can be divided into three distinct physical regions: the first is the steppe which comprises the northern half of the peninsula and is an extension of the Ukrainian Steppe; the second is the Kerch Peninsula in the east; and the third are the mountains which cover the southern part (Ferring 1998).

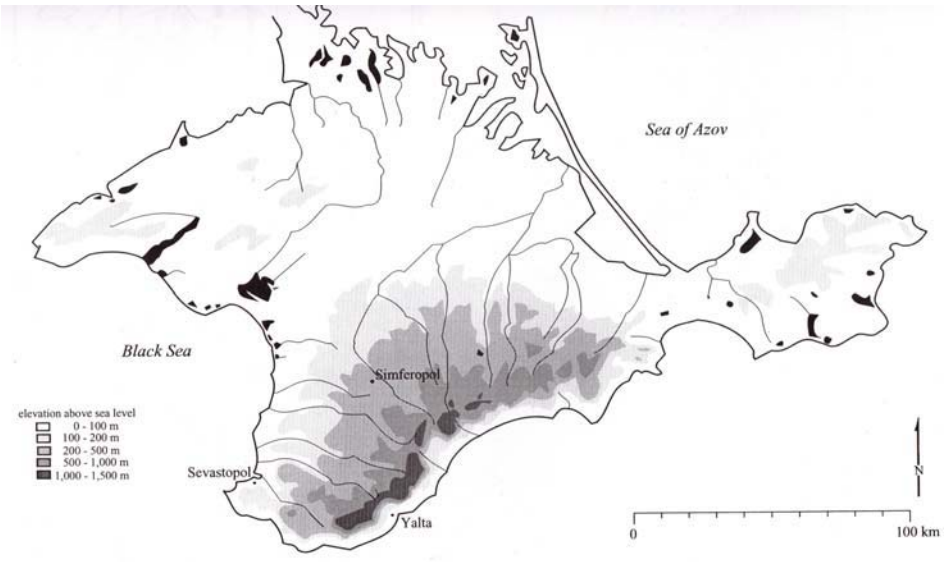


Figure 2.1.1- Map of the Crimean Peninsula modified from Ferring (1998, 19)

The Crimean Mountains are composed of three chains: the coastal chain, the internal chain, and the northern chain. The coastal chain is comprised of Triassic, Jurassic, and Cretaceous limestones and is characterized by karstic terrain (Ferring 1998). At its highest point, the coastal chain sits at an elevation of over 1500 m a.s.l. The internal chain is comprised of Cretaceous and Paleogene limestones and has a maximum elevation of 500m a.s.l. The northern

chain is comprised of Paleogene and Neogene limestones; its maximum elevation is around 300 m a.s.l. (Ferring 1998, 17).

The sheltered location of the internal range, between the coastal and northern chains of the Crimean Mountains, protects it from the inhospitable winters experienced on the northern steppe and has permitted the development of mosaic habitats which include grassland on the cuestas and forested river valleys (Ibid). The current mean annual temperature in the area around Simferopol is 10ºC and the region experiences relatively little precipitation, especially in winter, when compared to other parts of the peninsula (Ferring 1998). Its unique topography, climate as well as the resultant vegetation and animal life would have made the internal mountains most attractive to Middle Paleolithic humans as evidenced by the large concentration of sites that have been identified in this area.

2.2-The Crimean Middle Paleolithic

It should be pointed out that western Crimea contains the largest concentration of Middle Paleolithic sites in Eastern Europe and has had a long history of Paleolithic investigations which span a period of more than 100 years (Hoffecker 2002; Chabai 1998a).

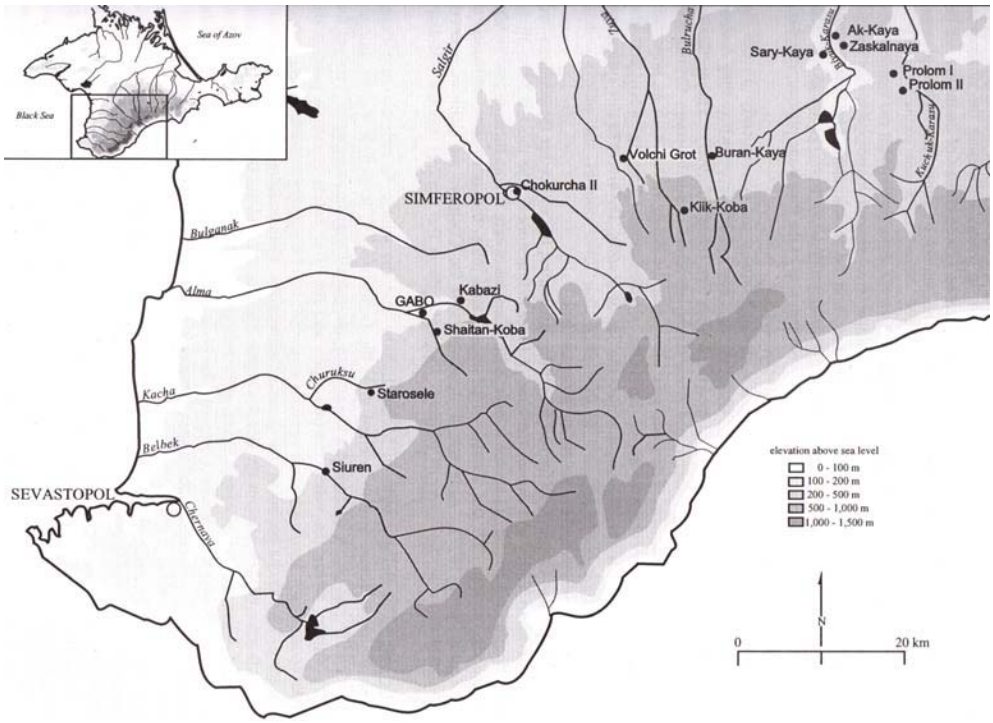


Figure 2.2.1- Map of the Crimean Mountains and the distribution of Middle Paleolithic sites modified from Ferring (1998, 21).

The first discovery of Mousterian artifacts in Crimea was reported by K. Merejkowski in 1880 at the cave of Volchii Grot near the city of Simferopol (Chabai 1998a). In 1924 the first Neanderthal remains were found at Kiik-Koba by G.A. Bonch-Osmolovskii (Hoffecker 2002; Chabai 1998a) indicating that Neanderthals were responsible for the Micoquian assemblages found in this region. Unfortunately, no Neanderthal remains have been found in association with Mousterian assemblages to date (Burke et al 2008; Monigal et al 2006)

In the decades following World War II, an additional 12 locations including rock shelter and cave sites as well as several open-air localities were discovered (Ferring 1998; Chabai 1998a; Hoffecker 2002). During this time period, additional Neanderthal remains were discovered at the cave sites of Zaskal'naya V and VI and it was believed Starosel'e. The remains from Starosel'e believed to be a Neanderthal-Modern human hybrid, later turned out to be an intrusive Muslim burial possibly dating to the Middle Ages (Marks et al 1998). Since then several other Middle Paleolithic sites have been discovered (Chabai 1998b).

According to Ferring (1998, 24) the distribution of Middle Paleolithic sites in southern Crimea is determined by the combination of bedrock composition, the structural configuration of the mountains and their erosional history as well as climate. For instance, few Middle Paleolithic sites have been identified in the coastal chain or in the Crimean steppe; this absence is believed to be the result of a lack of surface water, lithic raw material sources, and mean seasonal temperatures. Temperatures in the coastal chain can drop below freezing in summer due to high altitudes and winters on the steppe are bitterly cold, with heavy snow falls. Most known Middle Paleolithic sites are situated along the internal chain, with a fair number in the west near the present day city of Simferopol. This particular region has been subject to a fair amount of uplift and a series of streams and rivers have led to the formation of cuestas and deep canyons (Ferring 1998). East of Simferopol, the terrain gradually flattens out and merges with the northern steppe (Ibid.). Erosional processes in the south-west have led to the exposure of numerous flint sources and the formation of benches, platforms and rock shelters on the slopes of these cuestas and canyons (Ferring 1998; Uthmeier 2005).

2.3-Kabazi II: Excavation History and General Description

The discovery of the first Middle Paleolithic artifacts on Kabazi Mountain dates back to 1880 (Chabai 1998b). It was not until the mid 1950's that the first stratified site, a buried rock shelter (Kabazi I) was discovered and excavated however by the early 1960's a team of geologists discovered more than 20 locations with Middle Paleolithic surface material along the northern and western slopes of Kabazi Mountain. During the 1970's more of these locations were discovered as the result of a tree planting project to prevent soil erosion (Chabai 1998b). In 1983, Yuri Zaitzev discovered the collapsed rock shelter, Kabazi V, and in 1985 a new survey under the direction of Zaitzev found the stratified open air site Kabazi II as well as two surface scatters of Middle Paleolithic artifacts and bones, Kabazi III and Kabazi IV. To date two additional locations Kabazi VI and Kabazi VII, as well as another collapsed rock shelter: Kabazi VIII, have been identified (Chabai 2008) (Figure 2.3.1).

Figure 2.3.1- Distribution of Middle Paleolithic sites (indicated by roman numerals) on Kabazi Mountain modified from Chabai (2007, Fig 1-1).

At first it was believed that Kabazi II was a collapsed rock shelter that had been buried by slope deposits. When excavations started in 1986 it was discovered that this was not the case, however (Chabai 1998b, 2005). As it turned out, Kabazi II represents a deeply stratified series of occupations that had accumulated in an open air context behind a large, 10m tall, limestone slab situated on the upper part of a south facing slope of Kabazi Mountain. This slab apparently played a crucial role in site selection by the Middle Paleolithic humans and the subsequent preservation of their occupations since the area behind the slab represents a sizable, level surface where a group of people could work or camp. Each successive occupation was buried and preserved in sudden slope wash events which accumulated behind the block (Chabai 1998b, 2005; Ferring 1998).

Excavations continued at Kabazi II into the 1990's, and six main archaeological units (Units I, A, II, IIA, III, IV, V, and VI) have been recognized, in which total of 74 archaeological levels have been excavated (Chabai 2005).

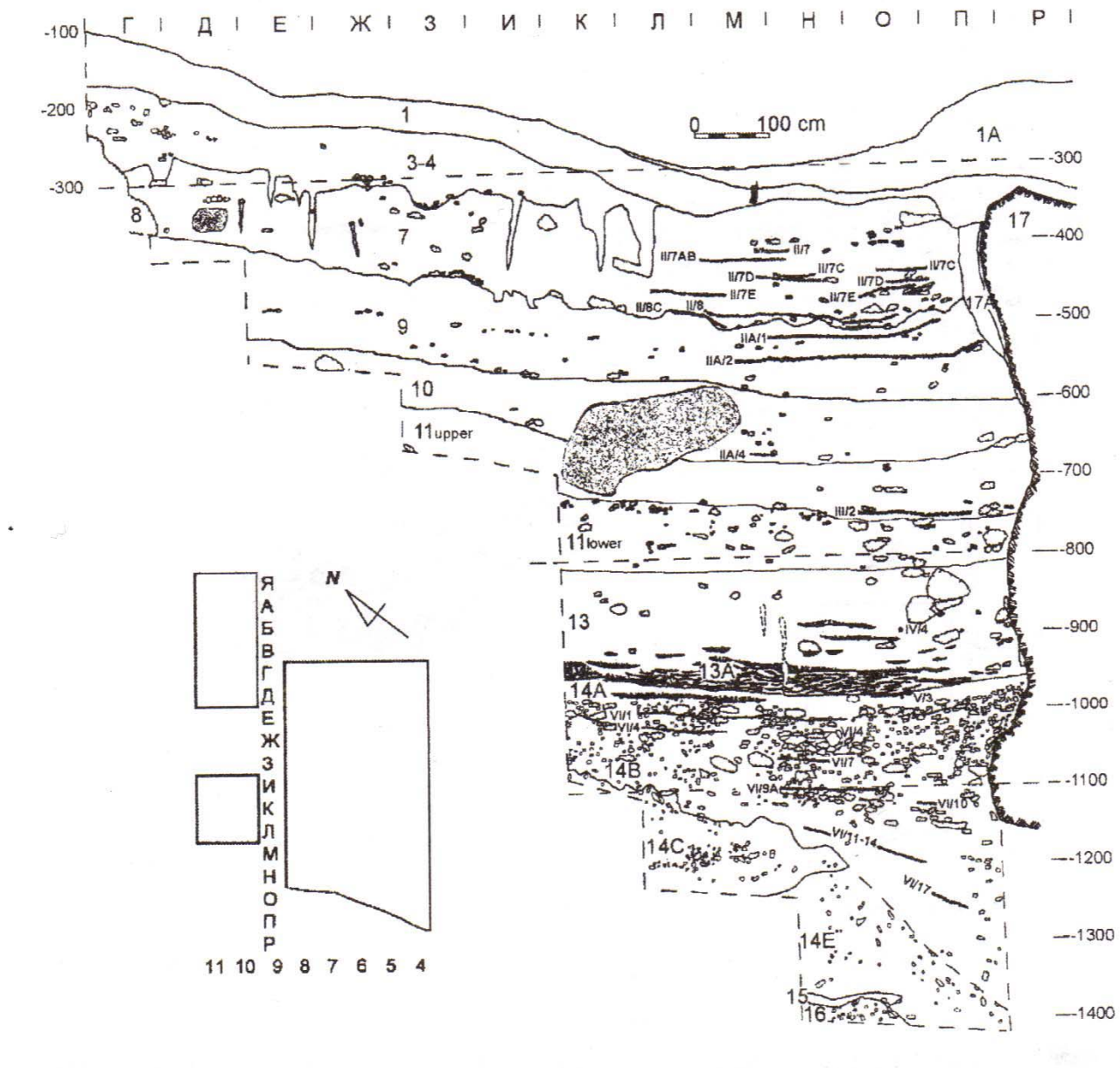


Figure 2.3.2- Kabazi II, section along the line of squares 3/4 modified from Chabai (2005, 5): Combined roman and Arabic numerals beside scatters (dark horizontal lines) indicate unit and level respectively.

Unit I yielded very little archaeological material and the few tools recovered, are badly damaged and their edges are heavily patinated and naturally chipped indicating that they had been transported down slope from another site above (Chabai 1998b). It was therefore concluded that Unit I represents sediments that had been re-deposited as the result of slope movement (Chabai 1998b). Evidence of secondary deposition has been observed on a small portion of the

material in some of the assemblages from other units, most of the archaeological material in the other units was *in situ* however.

The archaeological levels from all units are believed to represent isolated, short-lived occupations since the distribution of bones and artifacts is closely delineated and the thickness of most scatters is equal to the thickness of a single bone or artifact (Chabai 1998b, 181-183, 2005, 10-17). The only exception is Level II/8 in Unit II which, represents the most intense and prolonged occupation of the entire sequence (Chabai 1998b 178, 2005, 12; Patou-Mathis 2006, 58).

It is now recognized that Kabazi II was sporadically occupied from the middle of the Eemian Interglacial (OIS 5d) to the beginning of the Late Plenniglacial (OIS 3/2) (Chabai 2005, 11-Table 1-1). In other words, Kabazi II was occupied over a period of about 100 000 years. This makes Kabazi II the most chronologically complete Middle Paleolithic site in all of Eastern Europe (Hoffecker 2002; Chabai 1998a, 2005). However, beyond the extensive occupational history, what makes Kabazi II particularly interesting is that even though the lithic industries, regional climate, and vegetation underwent a series of changes, it would appear that the subsistence activities of its Neanderthal occupants did not (Patou-Mathis 2006a, 2006b, 2005, 2003, 1999).

2.4-The Results of Previous Studies

2.4.1-Paleo-Climate and Vegetation Cover

The climate reconstructions for the area surrounding Kabazi Mountain are based in part on the remains of micro-mammals and snails recovered from Kabazi II were conducted by Markova (2005, 1999, 2007) and Mikhailesku (2005, 1999, 2007) respectively. Furthermore, the micro-mammal and snail data sets derive from Units VI, V, IV, and III (Markova 2005; Mikhailesku 2005). Palynological studies conducted by Gerasimenko (2005, 1999) also inform us about climate trends for Units VI, V, IV, and III. These will be used where palynological and snail data are unavailable.

Unit VI

The occupations in this unit correspond to the earliest occupations at Kabazi II. The climatic conditions in effect during the occupation of Levels VI/17 to VI/3 was generally humid and warm (Markova 2005; Mikhailesku 2005) and the vegetation shifted between deciduous and mixed forest along the banks of the Alma River (Gerasimenko 2005). The steppe vegetation was characterized by a dominance of sedges and herbs with lower relative proportions of grasses (Gerasimenko 2005). During the occupation of levels VI/2 and VI/1 the climate gets drier however mixed forests persist along the banks of the Alma (Gerasimenko 2005). The occupations of levels VI/2 and VI/1 corresponds to the Eemian Interglacial; OIS sub-stage 5d (Chabai 2005, 11-Table 1-1).

Unit V

The occupation of levels V/6 to V/3 corresponds to a warm and humid period marked by a sharp increase in ground water in the vicinity of Kabazi II (Markova 2005; Mikhailesku 2005; Gerasimenko 2005). According to Mikhailesku (2005, 73), this increase in ground water may indicate the presence of nearby spring. The vegetation is characterized by the slight retreat of trees, possibly due to the increase in ground water and poor drainage properties of the sediment which had formed during this time (Gerasimenko 2005, 36). The steppe vegetation was characterized by a dominance of shrubs over grasses (Markova 2005; Gerasimenko 2005). Like Levels VI/2 and VI/1, levels V/6 to V/3 were likely formed during the Eemian Interglacial; OIS sub-stage 5d (Chabai 2005, 11-Table 1-1).

According to Gerasimenko (2005, 39) the overall environmental history and evolution of Kabazi II can be divided into two main parts: the first corresponds to the formation of Units VI, V, IV and Levels III/8E to III/2A in Unit III wherein environments fluctuated between temperate and southern boreal types. The second corresponds to Levels III/2, III/1, and III/1A in Unit III, Unit IIA, Unit II, and Unit A wherein environments fluctuated between southern boreal and boreal types and there is a general trend towards the decrease in deciduous trees and temperate herbs on the landscape. These oscillations reflect a cyclic pattern of environmental evolution that

occurred during the Late Pleistocene (Gerasimenko 2005, 48). These climatic shifts affected erosion processes within the region, which had a direct influence on the distribution and accessibility of flint sources across the landscape over the course of the extensive occupational history of Kabazi II (Richter 2005, 2006; Uthmeier 2005a, 2005b; Ferring 1998).

Unit IV

The occupations in Levels IV/2 and IV/1 correspond to colder and drier glacial conditions according to the analyses of the snail remains recovered from these levels (Mikhailesku 2005, 73). However, the results of the pollen analyses suggest cold but humid conditions based on the dominance of fir trees in the area and the expansion of mountain forest belts along the slopes of Kabazi Mountain (Gerasimenko 2005, 37). Levels IV/2 and IV/1 were likely formed during the Brørup interstadial, OIS sub-stage 5c (Chabai 2005, 11-Table 1-1).

Unit III

Cold and dry conditions persisted during the occupation of Levels III/8E to III/2A and the landscape was characterized by the further retreat of trees and the emergence of semi-desert vegetation marked by the increase of worm wood (Markova 2005; Mikhailesku 2005; Gerasimenko 2005). There is a slight period of climatic amelioration during the occupation of Levels III/2 and III/1A evidenced by a brief reappearance of mixed forest along the banks of the Alma River (Gerasimenko 2005, 37). However, the climate apparently deteriorates during the occupation of Level III/1 and the mixed forest disappears (Gerasimenko 2005, 37). The occupations in Unit III span a period that encompasses the Brørup Interstadial (Levels III/8E to III/8A), the Redderstall Stadial (Levels III/8 to III/2A), and the Ognon Interstadial (Levels III/1A and III/1). These correspond to OIS sub-stages 5c to 5a and the transition between stages 5 and 4 (Chabai 2005, 11-Table 1-1).

Unit IIA

There is a lack of micro-mammal and snail remains in Units IIA, II and A. The only climatic information for this Unit and the ones that follow is based on the results of the palynological studies conducted by Gerasimenko (2005).

Levels IIA/4B to IIA/4 are characterized by cold and dry conditions; the landscape was covered by thin pine forest and steppe vegetation prevailed. During the occupation of Levels IIA/3A to IIA/3B climatic conditions improve and the forests expand slightly. Deciduous trees reappear although the forests are still dominated by pine. The climate becomes increasingly arid during Levels IIA/2-3 to IIA/2. At this time, the forests retreat and the steppe is characterized by meadow steppe vegetation. The climate begins to improve again during Level IIA/1 (Gerasimenko 2005). These occupations span a period from the end of the Brørup Interstadial (Level IIA/4B), the Moershoofd interstadial (Levels IIA/4 to IIA/3), the Hosselo Stadial (Levels IIA/2-3 to Levels IIA/2) and the beginning of the Hengelo Interstadial (Level IIA/1). These correspond to OIS stages 4 and 3 (Chabai 2005, 11-Table 1-1).

Unit II

During the occupation of Levels II/8C and II/8 the climate continues to improve and precipitation increases based on the sudden appearance of ferns in the vicinity of Kabazi II. The forests begin to expand and are dominated by pine; however some deciduous trees such as birch and alder are present. Conditions begin to cool during the occupation of Levels II/7E and II/6. The vegetation is characterized by the disappearance of deciduous trees and the presence of thin pine forest and herbaceous plants. By the time the occupation of Levels II/3 to II/1 occurred, the climate becomes increasingly cold and dry. Consequently, trees disappear completely with the exception of a few scattered alder along the banks of the Alma River. Grassland conditions dominate the landscape for the first time in the vegetation history of the region. Nevertheless, conditions appear to warm up during the occupation of Level II/1A and deciduous trees reappear. The steppe at this time consists of grasses and herbs (Gerasimenko 2005). The occupations in Unit II span OIS stage 3 from the Hengelo Interstadial (Levels II/8C to II/7E), Huneborg

Interstadial (Level II/6), Huneborg Stadial (Levels II/3 to II/1), to the beginning of the Denekamp Interstadial (Level II/1A) (Chabai 2005, 11-Table 1-1).

Unit A

The climate becomes more arid during the occupations of Levels A/3A and A/4 to A/3A, trees retreat, and grassland dominates. These occupations span a period between the Denekamp Interstadial (Levels A/3A and A/4 to A/3A) and the Bug Stadial (Levels A/3 to A/A) which correspond to OIS stages 3 and 2 (Chabai 2005, 11-Table 1-1).

Strata	Unit/Level	Dates (kyrs, B.P.) AMS	U-Series	ESR	OIS	Climate Phase	Characteristics of Local Climate/Vegetation
2-3	I/1, I/2, I/2A, I/3						
4-5	A/A, A/1, A/2, A/3				2	Bug bg1	Arid/boreal grassland
5	A/3A, A/3B, A/3C, A/4				2	Vytachiv vt3b	Arid /south-boreal forest steppe
6	II/1A		32.1±6.5	30±2.0	3	Denekamp Interstadial	Temperate /south-boreal to boreal forest steppe
7	II/1	31.6±0.6	40.1±5.0		3	Huneborg Stadial	Cold & arid /boreal xeric grassland
	II/2	35.1±0.85			3	Huneborg Stadial	Cold & arid /boreal xeric grassland
	II/3				3	Huneborg Stadial	Cold & arid /boreal xeric grassland
	II/4	32.2±0.9			3		-No pollen-
	II/5	33.4±1.0			3		-No pollen-
	II/6				3	Huneborg Interstadial	Cold & arid/boreal to south-boreal forest steppe
	II/7		46.5±8.0		3	Huneborg Interstadial	Cold & arid/ boreal to south-boreal forest steppe
	II/7AB			36±3.0; 38±4.0	3		Cold & arid/south-boreal forest steppe
	II/7C, II/7D, II/7E				3		Cold & arid/south-boreal forest steppe
	II/8			44±5.0	3		Temperate & humid/ south-boreal forest steppe
	II/8C				3	Hengelo Interstadial	Temperate & humid/ south-boreal forest steppe
9	IIA/1				3	Hengelo Interstadial	Temperate / south-boreal forest steppe
	IIA/2, IIA/2-3				3	Hosselo Stadial	Cold & arid/boreal to south-boreal forest steppe with xerophytes
	IIA/3, IIA/3A, IIA/3B				3	Moershoofd Interstadial	Temperate/south-boreal forest steppe
10	IIA/4A				3	Moershoofd Interstadial	Cold & arid/south-boreal forest steppe
	IIA/4B				4	Uday ub	Cold & arid/boreal forest steppe
11 Upper	III/1A				4;5	Ognon Interstadial	Cold & arid/ boreal to south-boreal forest steppe
	III/1				4;5	Ognon Interstadial	Temperate/ boreal to south-boreal forest steppe
	III/2		54±3.0	74-85	5a	Odderade Interstadial	Temperate/south boreal forest steppe
11	III/2A				5b		Cold & arid/ boreal to south-boreal forest steppe
Lower	III/3			82±10	5b	Pryluki pl1b2-b1	Cold & arid/ boreal to south-boreal forest steppe
	III/4, III/5, III/6, III/7, III/8				5b	Pryluki pl1b2-b1	Cold & arid/ boreal to south-boreal forest steppe
	III/8A, III/8B, III/8C,III/8D, III/8E				5c	Pryluki pl1b1	Cold & arid/south-boreal forest steppe
13	IV/1				5c	Brørup Interstadial	Cold & arid/mountain forest belts and grassland dominate
	IV/2, IV/3, IV/4, IV/5				5c	Brørup Interstadial	Temperate/ south boreal forest steppe
13A	V/1, V/2, V/2A				5d	Herning Stadial	-Not Sampled-
14A	V/3, V/4, V/5, V/6				5d	Eemian Interglacial	Warm & humid/forest steppe of temperate to south boreal climate
14B	VI/1, VI/2,				5d	Eemian Interglacial	Arid climate/south boreal forest to forest steppe
	VI/3, VI/4, VI/5, VI/6, VI/7, VI/8						
	VI/9, VI/9A, VI/10						
	VI/11-14, VI/15						
	VI/16, VI/17				5d	Eemian Interglacial	Warm & humid/south boreal forest to forest steppe

Table 2.4.1- Summary of climatological data provided by Gerasimenko (2005), Markova (2005), and Mikhailesku (2005) for the occupations at Kabazi II modified from Chabai (2005a, Table 1-1) and Gerasimenko (2005, Table 2-1)

2.4.2-Lithic Industries and Raw Material Procurement

Two main Middle Paleolithic tool industries that have been identified in Crimea over the past century include: the Crimean Micoquian and the Western Crimean Mousterian (WCM). The Crimean Micoquian is characterized by Levallois reduction methods with a pronounced component of bifacial tools and was originally thought to represent a late variant of the Acheulean (Chabai 1998a, 3). The WCM is characterized by Levallois reduction methods and the exclusive manufacture of unifacial tools. However, as archaeological investigations continued over the last century, several variants of these industries had been discovered forcing the development of new typological sub-divisions based on the relative proportions of certain tool types and reduction methods employed.

The Crimean Micoquian is subdivided into three distinct *faciès* which include the *Ak-Kaya*, the *Kiik-Koba*, and the *Staroselian* (Chabai 1998a, 11-12). The Ak-Kaya *faciès* is characterized by an absence Levallois debitage, and a low percentage of faceted platforms and blades. These assemblages are dominated by bifacial and canted scrapers which comprise roughly 80% of tools and only a few bifacial and unifacial points. In general, bifacial tools constitute 16 to 30% of these assemblages (Chabai 1998a, 11). The Ak-Kaya has been identified in the occupations of Units VI and V at Kabazi II (Chabai 2005b, 127).

The Kiik-Koba *faciès* is characterized by pronounced homogeneity in assemblage composition which is dominated by radial and discoidal cores as well as bifacial and unifacial points. Blades, faceted platforms, and scrapers are found in relatively smaller proportions (10-40%) (Chabai 1998a, 11). Assemblages associated with the Kiik-Koba *faciès* are found in the occupations of Unit IV at Kabazi II (Chabai 1998a, 15-Table 1-1).

Assemblages of the Staroselian *faciès* are characterized by bifacial leaf points (2%), bifacial and unifacial scrapers (60%) as well as notched and denticulated tools (15%). The relative proportion of bifacial tools in these assemblages varies between 4 to 12% which are primarily represented by different shaped points (Chabai 1998a, 11). The Staroselian *facie* has been identified at Kabazi II in the occupations of Unit III (Chabai 1998a, 15-Table 1-1).

WCM assemblages are characterized by the complete absence of bifacial tools, roughly 18 to 20% points, 65% scrapers, and a low proportion of denticulates (<10%). Lateral and distal points on blades are common, and the vast majority (80%) of scrapers are simple (Chabai 1998a, 13). WCM assemblages have been identified at Kabazi II among all occupations in Units A and II as well as Unit IIA, Levels IIA/1 and IIA/2 (Chabai 1998a, 2005a, 2006). Chabai (1998a) proposes a three stage sub-division of the WCM which is based on differences in the primary reduction of cores observed among the WCM assemblages at Shaitan-Koba and Kabazi II.

The first WCM type consists of primarily parallel, single and opposed platform cores as well as by Levallois tortoise and radial cores. Faceted platforms and blades are common and Levallois blanks with centripetal dorsal scar patterns are also present. Assemblages of this type have been identified at Kabazi II in Level II/8 (Chabai 1998a, 13). The second type consists of a pronounced dominance of parallel, single and opposed platform cores, while Levallois and radial cores are rare, if not completely absent. Assemblages of this type have been identified at Kabazi II in Levels II/1A to II/7 (Ibid). The third type contains many of the same characteristics as the second, with a pronounced volume of flaking surfaces, blades comprise from 30 to 40% of all blanks. Assemblages of this type have been identified in Levels II/1 and II/1A at Kabazi II (Ibid).

Strata	Unit/Level	Dates (kyrs, B.P.) AMS	U-Series	ESR	Lithic Industry
2-3	I/1, I/2, I/2A, I/3				
4-5	A/A, A/1, A/2, A/3				
5	A/3A,A/3B, A/3C, A/4				WCM
6	II/1A		32.1±6.5	30±2.0	WCM-Type 3
7	II/1	31.6±0.6	40.1±5.0		WCM-Type 3
	II/2	35.1±0.85			WCM-Type 2
	II/3				WCM-Type 2
	II/4	32.2±0.9			WCM-Type 2
	II/5	33.4±1.0			WCM-Type 2
	II/6				WCM-Type 2
	II/7		46.5±8.0		WCM-Type 2
	II/7AB			36±3.0; 38±4.0	WCM
	II/7C, II/7D, II/7E				WCM
	II/8			44±5.0	WCM-Type 1
	II/8C				WCM
9	IIA/1, IIA/2				WCM
	IIA/2-3, IIA/3, IIA/3A, IIA/3B				
10	IIA/4A, IIA/4B				Crimean Micoquian
11	III/1A, III/1				Crimean Micoquian-Staroselian *faciès*
Upper	III/2		54±3.0	74-85	Crimean Micoquian-Staroselian *faciès*
11	III/2A				Crimean Micoquian-Staroselian *faciès*
Lower	III/3			82±10	Crimean Micoquian-Staroselian *faciès*
	III/4, III/5, III/6, III/7 III/8, III/8A, III/8B, III/8C III/8D, III/8E				Crimean Micoquian-Staroselian *faciès*
13	IV/1, IV/2, IV/3, IV/4, IV/5				Crimean Micoquian-Kiik Koba *faciès*
13A	V/1, V/2, V/2A				
14A	V/3, V/4, V/5, V/6				Crimean Micoquian-Ak Kaya *faciès*
14B	VI/1, VI/2, VI/3, VI/4, VI/5 VI/6, VI/7, VI/8, VI/9, VI/9A VI/10, VI/11-14, VI/15, VI/16, VI/17				Crimean Micoquian-Ak Kaya *faciès*

Table 2.4.2- Summary of lithic industries represented among the occupations at Kabazi II after Chabai (2005a, 2005b, 1998a, 2006): "Type" refers to the three sub-divisions of the Western Crimean Mousterian (WCM) proposed by Chabai (1998a, 13).

The absolute and even relative chronology of the Micoquian and WCM is unknown (Chabai 1998a). The general trend suggests that the Crimean Micoquian preceded the WCM, since it is found in older, underlying occupations at such sites as Kabazi II (Table 2.3.2), Shaitan Koba, and Karabi Tamchin (Chabai & Marks 1998; Chabai 2006, 2008). However, at Kabazi V the two industries are inter-stratified. The absolute dates for the sites at which they occur are too inconsistent to permit comparisons and most of the collections from earlier excavations have gone missing (Chabai 1998a). It does not appear that these industries and their associated

subdivisions reflect distinct Middle Paleolithic cultural entities as proposed by Kolosov and Stephanchuk however (cf. Chabai 1998a, 14). Rather, the evidence from Kabazi V and Unit II from Kabazi II suggests that the Crimean Micoquian and WCM were contemporary. In addition to differences in assemblage composition between the Crimean Micoquian and WCM, there are differences in the pattern of raw material import and procurement between these two industries (Richter 2005, 2006; Uthmeier 2005a, 2005b; Kretschmer 2006).

During the occupations associated with the Crimean Micoquian in Units VI, V, IV, III, and IIA, Levels IIA/4B to IIA/4, there is an overall lack of cores and cortical flakes and a high proportion of decorticated blanks (Uthmeier 2005a, 2005b). According to Uthmeier (2005a, 149), this implies that the occupants of Kabazi II were obtaining their raw material from a more distant source, rather than in the immediate area-in contrast to the later WCM occupations (Bataile 2006, 114). Furthermore, Uthmeier (2005a) suggests that based on the age of the flint (Cretaceous), types of inclusions, and color, the occupants of Kabazi II were likely obtaining raw materials from the Bodrak Valley, situated roughly 6km from Kabazi II (however the exact source has not been identified).

In contrast there is a marked increase in presence of cores and cortical flakes in the WCM assemblages in Unit II (Bataille 2006; Chabai 1998c, 1998d). This suggests that a more local flint source was being exploited during that time. The most likely location, based on trace analyses, is an outcrop at Mount Milnaya, situated 1km to the southeast of the site (Bataille 2006; Richter 2006). It is believed that the source at Mount Milnaya had been exposed by erosion at around 45 000-40 000 BP at the onset of the Hengelo Interstadial (Uthmeier 2006; Richter 2006). In addition, there is evidence from both the Crimean Micoquian and WCM assemblages that a minority of finished tools were imported to Kabazi II from sources as far away as 20 to 60 km (Uthmeier 2005a, 2005b; Bataille 2006).

The high incidence of hasty, bifacially worked blanks and retouched flakes among the Micoquian assemblages and the high incidence of blades among the WCM assemblages indicates that the primary activity at Kabazi II was butchering animals (Chabai 1998c, 1998d). More

specifically, the focus was on butchering *Equus hydruntinus*, and this activity apparently remained unchanged throughout its extensive history of occupation.

2.4.3-Faunal Remains

Prior to this study, the faunal remains from levels in Units II, IIA, III, V, and VI at Kabazi II have been analyzed. In General, the faunal remains recovered from Kabazi II are in a good state of preservation except for Unit IV, which yielded very little to no faunal material at all (Chabai 1998b; 2005) . The preservation of the faunal material in most assemblages is by and large the product of rapid burial in alkaline sediments. The first analyses of the faunal material recovered during the 1986-1988 field seasons were conducted by N.G. Belan (cf. Chabai 1998b) this task was then later handed over to M. Patou-Mathis who conducted the analyses on the assemblages from the lower part of Unit II as well as those in Units IIA, III, V, and VI (Patou-Mathis 2006a, 2006b, 2005, 2003, 1999).

The remains of *Equus hydruntinus* account for anywhere from 80% to 90% of the identified remains in any given assemblage. In addition, two nearly complete crania belonging to *Equus hydruntinus* were recovered in Level IIA/2 (Burke 2006) which represents the only two complete crania ever recovered for this extinct taxon. DNA analyses conducted on the crania confirm that *Equus hydruntinus* was most closely related to the Asiatic ass (*Equus hemionus*) than to any other equid taxon (Orlando et al 2006).

Other mammal species are present at Kabazi II although poorly represented (See Table 2.4.3).

	Species Name	Common Name
Large Artiodactyls		
	Bison priscus (Bojanus 1827)	Steppe Bison
	Cervus elaphus (Linneaus 1758)	Red Deer
	Megaloceros giganteus (Blumenbach 1799)	Giant Deer
Medium/Small Artiodactyls		
	Saïga tatarica (Linnaeus 1766)	Saiga Antelope
	Sus scrofa (Linnaeus 1758)	Wild Pig
	Rupicapra rupicapra (Linnaeus 1758)	Chamois
Perissodactyls		
	Coelodonta antiquitatis (Blumenbach 1807)	Wholly Rhinoceros
	Equus hydruntinus (?)	Wild Ass
	Equus caballus (Linnaeus 1758)	Horse
	Equus latipes (?)	Latipes Horse
Carnivores		
	Pantera leo spelaea (Goldfuss 1810)	Cave Lion
	Ursus spelaeus (Rosenmüller 1794)	Cave Bear
	Canis lupus (Linnaeus 1758)	Wolf
	Cuon alpinus (Pallas 1811)	Dhole (Asiatic wild dog)
	Vulpes vulpes (Linnaeus 1758)	Red Fox
	Alopex lagopus (Linnaeus 1758)	Arctic Fox
	Mustelidae sp. (Fischer de Waldheim 1817)	Weasel, Badger (Unidentified)
Rodents		
	Marmota bobac (Müller 1776)	Bobac Marmot
	Oryctolagus cuniculus (Lilljeborg 1873)	European Rabbit
	Lepus europaeus (Pallas 1778)	European Hare

Table 2.4.3– List of mammal species identified at Kabazi II after Belan (cf. Chabai 1998b) and Patou-Mathis (2006a, 2006b, 2005, 2003, 1999).

The results of previous faunal analyses demonstrated that the subsistence strategies of the occupants of Kabazi II remained unchanged, regardless of changes in climate and lithic industries. It is hypothesized that the hunting strategies of the Neanderthals were highly specialized and were focused on ambushing small herds of *Equus hydruntinus*, primarily groups comprised of females accompanied by their young during a period that spanned the late spring, summer and autumn months (Chabai 1998b; Patou-Mathis 2006a, 2006b, 2005, 2003, 1999). The other species namely the large as well as medium/small artiodactyls and possibly the rodents, represent chance encounters which resulted in opportunistic kills.

This study, which analyzes previously unpublished collections from Unit II, Levels II/1, II/2-1, II/2, II/3, II/4, II/5, II/7, II/8, II/9, II/13, and II13A seeks to complete the existing information regarding the subsistence activities at Kabazi II by testing the following hypotheses:

The first deals with Richter's (2005, 277) proposal that the unchanging economic and functional patterns observed over the long occupational sequence at Kabazi II is directly attributed to the region in which the site is located. In other words, the sheltered location of the inner chain of the Crimean Mountains served as a natural "refugium" for both animals and Middle Paleolithic humans especially during periods of climatic deterioration. The second involves Patou-Mathis' (2006a, 2006b, 2005, 2003, 1999) interpretation of site function which states that Kabazi II had served as a kill and butchery site throughout its occupational history at which the specialized, seasonal, hunting of small groups of *Equus hydruntinus* took place. The third deals with the nature of Neanderthal settlement patterns among the complex network of sites along Kabazi Mountain. More specifically, the possibility that a functional link exists between the Western Crimean Mousterian occupations at Kabazi II and those at the nearby rock shelter, Kabazi V as suggested by Chabai (2008, 523).

III-Materials & Methods

3.1- Materials

A previously unanalyzed collection of faunal remains from Levels II\1, II\2-1, II/2, II\3, II\4, II\5, II\7, II\9, II\13, II\13A, and a sub-sample from Level II/8 was made available for study. It must be noted that the relatively small number of samples in each of these assemblages limits the analysis that follows.

3.1.1-Preparation and Data Recording

Preparation and taxonomic identifications for the faunal remains took place at the *Muséum National d'Histoire Naturelle- Institut de Paléontologie Humain* (Paris, France) from January to April 2009.

During these three months, the faunal remains were cleaned and marked before being sorted and then identified in terms of element and taxon. Age diagnostic characteristics (i.e. deciduous teeth, un-fused epiphyses) were recorded. Surface modifications were also recorded and photographed when warranted.

The variables recorded in the catalogue are as follows:

- Archaeological Level
- Catalogue Number
- Bag Number
- Square (where available)
- Quantity
- Element
- Side
- % Portion Represented: This was recorded on a scale from 20 to 100%. The names of specific anatomic locations, planes, and directions were included using Schmid (1972) and O'Connor (2000, 8-Table 2.1).

- Code for Part: We used Patou (1985) to code the specific location of surface modifications and fractures.

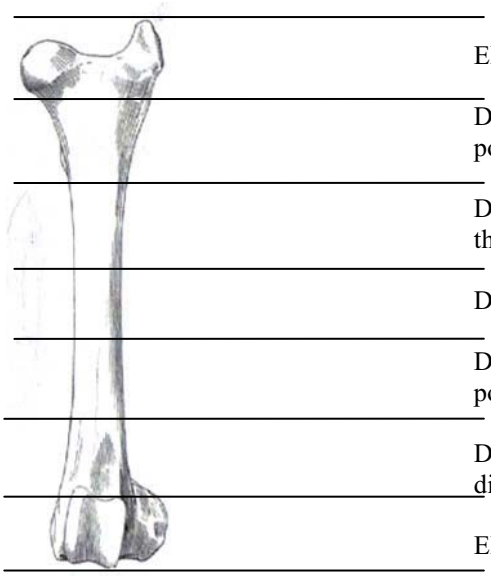


Figure 3.1.1- System of abbreviations for long bone parts developed by Patou (1985). Image modified from Schmid (1972).

- Species or Category: "Category" refers to the samples that could not be identified to the level of species. These were either classified in terms of body size and order (i.e. large and small artiodactyls), body size and class (i.e. large and small mammals), or simply marked as "unidentified".
- Taphonomy: The following surface modifications, were recorded: cut marks, preparation/excavation damage, flake scars, spiral fracturing, burning, gnaw marks, gastric juice polish, root etching, abrasion, weathering stage (cf. Behrensmeyer 1978, 153), dissolution, and manganese oxide staining.
- Age: Ages were determined by the presence of deciduous teeth as well as rates of eruption and wear in adult teeth based on the figures presented by Barone (1954) and Guadelli (1998). Ages based on ossification rates were also recorded based on the figures in Schmid (1972, 75-Table IX).
- General Comments

The catalogue number, provenience, taxonomic identification, element, side and % portion represented was transcribed onto cards before entering into the catalogue:

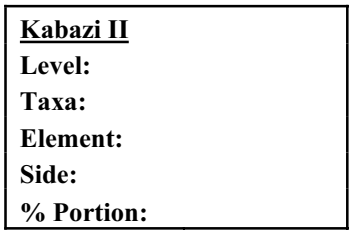


Figure 3.1.2- Example of an identification card.

This was done in order to keep track of each identified sample and maintain consistency with the catalogue during later phases of the analysis.

Bones were refitted where possible taking into account anatomical side, assessments of surface color and degrees as well as types of surface modification. This method of element reconstruction produces more accurate figures for the number of elements (MNE) as well as the number of individuals (MNI) than simply combining percentages of whole elements represented by each fragment per anatomic side.

Unidentified bone and tooth fragments were measured and divided into the following length classes:

- Class 1: Greatest Length= <10mm
- Class 2: Greatest Length= 10>20mm
- Class 3: Greatest Length= 20>50mm
- Class 4: Greatest Length= 50>100mm
- Class 5: Greatest Length= 100mm +

According to Patou-Mathis (2006a; 2006b) the quantification of length classes may aid in identifying agents responsible for post-depositional breakage. For instance, bone and tooth fragments corresponding to length Classes 1 and 2 may be produced by trampling, sediment weight, or rock falls whereas fragments in Classes 3, 4 and 5 may be the result of splintering caused by aridity or freeze-thaw cycles.

3.2-Quantification

3.2.1-Variables Used

Sample size is expressed in terms of three main variables. These include: the number of unidentified bone and tooth fragments, the number of remains identified to the level of species, the total number of samples, and the number of remains identified to the level of category. "Category" refers to the remains of large artiodactyls, small artiodactyls, large mammals, as well as small mammals.

The relative proportions of species in each assemblage will be expressed both in terms of %NISP and %MNE. % NISP is calculated as: (NISP/NISP total) x 100 and % MNE is (MNE/MNE total) x 100 (cf. Binford 1984). NISP counts alone can be misleading since a high number of fragments in a given assemblage may only be representative of a single element. The number of identified species is expressed in terms of Minimum Number of Individuals (MNI) taking into account differences in age and sex where possible (cf. Brugal et al 1994, 146).

Determinations of age are based on derived ages for deciduous teeth as well as rates of tooth eruption, wear and loss for *Equus hydruntinus* using the figures for equids provided by Barone (1954) and Guadelli (1998). Seasonality is inferred based on estimated ages and the assumption that births occur in late May and early June (Burke 2006). Age categories are based on figures for kulans in Baskin and Danell (2003, 12): **Yearling**-0 to 1 year, **Juvenile**-1 to 3 years, **Adult**-3 to 10 years, and **Senile**-10 to 15 years.

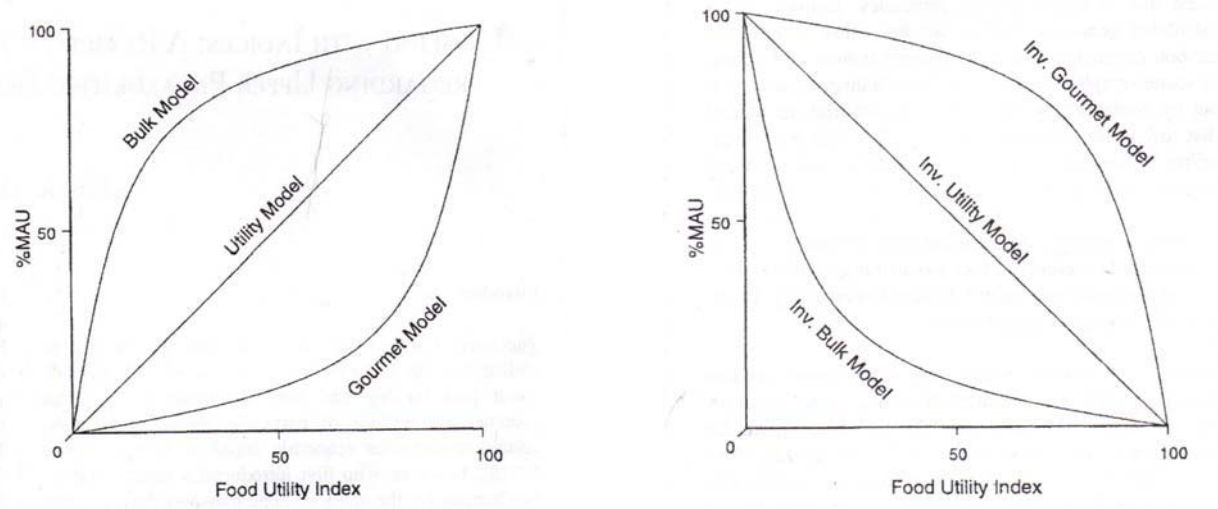
The relative representation of different portions of the *Equus hydruntinus* skeleton was expressed as a function of the anatomic regions defined in Stiner (1994) (see Appendix B). The relative abundance of individual elements is expressed in terms of %MAU where %MAU= (MAU/MAU max) x 100 and MAU= MNE/Qsp where Qsp (or specific coefficient) is the number of times an element occurs in an articulated skeleton of a given species.

The intensity of bone fragmentation as well as possible agents of post-depositional breakage are assessed in each assemblage through examination of the relative proportions of unidentified fragments within the size classes mentioned above (p.28).

3.2.2-Statistical Analysis

In order to assess the potential relationship between element representation and bone density, we test the correlation between the averaged mineral density values and element part abundance (%MAU) for the remains of *Equus hydruntinus* in each level where more than 4 individuals are represented using Spearman's Rho. Density values were averaged using values provided by Lam and colleagues (1999) since our element parts (i.e. the entire proximal humerus) correspond to more than one scanned location and density values vary depending on the location scanned.

Once the effects of *in situ* density-mediated destruction on element abundance are tested, the relation between element representation (%MAU) and associated food value (SFUI) for equid bones provided by Outram and Rowley-Conwy (1998, 845-Table 6) is assessed in order to test for selective transport (cf. Binford 1978). We choose SFUI as it is believed to improve upon Binford's "modified general utility index" (MGUI) (Outram & Rowley-Conwy 1998). Positive correlations (i.e. high proportions of high food value elements) would indicate selective transport in locations such as residential sites. Negative correlations (i.e. high proportions of low food value elements) indicate kill and butchery locations. Three general variants exist for each of these site types:



a) b)

Figure 3.2.1-Binford's (1978) correlation models for differential transport at a) transport destinations and b) at kill/butchery sites adapted from Outram (2006, 50).

The strength of the correlation is moderated by the abundance of prey for instance when prey is abundant hunters will consistently carry off select parts and leave otherwise high utility parts behind at the kill site as seen in the "gourmet model" whereas in leaner times, the "bulk model" occurs. It has been observed that Paleolithic equid assemblages are often dominated by low food value elements regardless of site function (Outram 2006; Lam et al 1999; Outram & Rowley-Conwy 1998). This can be the result of differential preservation of high density bone elements. The previous analysis should enable us to identify this effect. Another complicating factor may be that the food values (aka the food utility index) in Binford's models use the remains of sheep and caribou which, differ from the remains of equids in terms of the anatomic distribution of meat and marrow (Outram & Rowley-Conwy 1998). In addition, Outram (2006, 49-50) argues that although there is nothing inherently wrong with the application Binford's models they often lead to interpretive errors if they are not statistically validated since the observer will attempt to seek out patterns where none may exist. To overcome this, a Spearman's Rho test will be conducted to determine whether or not the correlations are statistically significant.

When the results of the Spearman's Rho test indicate a statistically significant relationship between %MAU and SFUI, element abundance is then tested against the meat and marrow weight indices for equid remains provided by Outram and Rowley-Conwy (1998, 840,842-Tables 1 & 3).

3.3- Qualitative Criteria for the Identification and Analysis Bone Modifications

The study of surface modifications is essential when inferring past subsistence behaviors, site function, as well as the effects of climate, the role of carnivores, plants, and the effects of diagenesis (Lyman 1994; Patou-Mathis 1994; O'Connor 2000; Fisher 1995). Critically, the analysis of surface modifications helps overcome ambiguity when attempting to identify and assess the role of the actor(s) (i.e. hominid or animal) or physical processes involved in assemblage formation (Patou-Mathis 1994; Fisher 1995; Lyman 1994; Marshal 1989).

For the purposes of this study, surface modifications will be grouped into three main categories: anthropogenic modifications, animal, and physical.

Anthropogenic modifications are traces left by human activities. Previous analyses of the faunal remains at Kabazi II undertaken by Patou-Mathis (1999, 2005, 2006a, 2006b, 2003) concluded that Kabazi II served as a butchery site at which the main quarry were small groups of *Equus hydruntinus*. The anthropogenic surface modifications covered in this analysis are concerned with butchery and processing activities. These include the identification of cut marks, patterns of bone breakage, and traces of combustion.

The second category of surface modification involves the identification and analysis of traces left by animals. Carnivores, rodents, and vultures have been known to form bone accumulations which may be confused with those generated by humans (Lyman 1994, 1987a; Fisher 1995; Binford 1981; Hill 1989; Mondini 2002; Stiner 1994; Niven 2006; Marrin-Arroyo et al 2009; Gifford 1981). Furthermore, animal traces left on bone in the form of tooth and claw marks, patterns of bone breakage, as well as scratches

made by digging and trampling may mimic those left by human butchery activities (Lyman 1994, 1987a; Binford 1981; Shipman & Rose 1983; Fisher 1995; Gibert & Jimenez 1991; Johnson 1989). Digestive juice etching may be confused with natural surface weathering in the form water dissolution (Stiner 1994; Phoca-Cosmetatou 2002). The surface modifications covered in this analysis will include gnaw marks, digestive juice polish and spiral fracturing.

The third category involves the identification and analysis of surface modifications caused by the physical and chemical effects of weathering, plants, and hydro-geological processes. For instance, the analysis of the degree and nature of surface deterioration through exposure to the elements may provide insight into the formation history of a bone assemblage as well as the climatic and vegetation conditions in effect at the time of deposition (Lyman & Fox 1989; Lyman 1994; Behrensmeyer 1978; Behrensmeyer et al 1989; Marshal 1989; Fisher 1995). Furthermore, pitting caused by water dissolution, discoloration through oxide staining and abrasion marks may provide information concerning the diagenetic and geological processes involved in the formation of a given assemblage (Stiner 1994; Shahack-Gross et al 1997; Lyman 1994; Potter & Rossman 1979). The surface modifications covered in this section include: Root etching, abrasion, weathering, dissolution, and manganese oxide staining.

The observed intensities of surface modifications as root etching and dissolution is expressed as follows:

P-: Weak Presence
P: Moderate Presence
P+: Strong Presence

Other modifications such as cut marks, flake scars, spiral fractures, traces of abrasion, and manganese oxide staining are simply counted (in terms of the number of observed cases). Surface weathering is expressed in terms of the 5 weathering stages defined by Behrensmeyer (1978, 151) and signs of combustion are expressed in terms of the 6 “color stages” defined by Cain (2005, 875-Table 1).

The Identification of Cut Marks

The general criteria applied in the identification of cut marks in this study are as follows (cf. Lyman 1994, 1987a; Shipman & Rose 1983; Fisher 1995; Behrensmeyer et al 1989):

1) They exhibit "V" to "U"-shaped cross section when viewed from above.
2) They are elongated.

And when viewed under a microscope cut marks may exhibit:

3) Multiple, fine parallel striations on the walls of the mark.
4) Display "shoulder effects" situated at the tail end of the cut mark created by contact between the bone's surface and the terminal end of the cutting edge (aka the "shoulder" of the tool).

Ancient cut marks were distinguished from those resulting from excavation damage based on the following criteria (after Gibert & Jimenez 1991, 126):

1) Differential color.
2) Absence of weathering on the internal surfaces.
3) Marked uplift of the cortex edge.

For an example of the visual differences between ancient and modern cut marks, see Appendix G (Image 1).

The identification of Spiral Fractures

The general criteria applied in the identification of spiral fractured bone and its distinction from dry fractured bone is as follows:

According to Johnson (1989, 433-434), a spiral fracture is defined as a tensile-shear failure in fresh long bones along a helical path that is inclined at a 45° angle to the longitudinal axis of the bone which, produces a partially or completely curvilinear pattern around the circumference of the shaft. Spiral fractures result from the dynamic loading of long bones (i.e. sudden concentrated impact on bone) which generates shear stress due to the twisting of fresh bone as it flexes. This shear stress is critical in the formation of the characteristic morphology of a spiral fracture since shearing stress combined with tensile stress produces the spiral fracture.

On the other hand, dry bone exhibits horizontal tensile failure in which the fracture front cuts across the diaphysis and produces diagonal, perpendicular, or parallel fracture fronts. As a result, dynamic loading of dry bone produces a different breakage pattern that appears to stepped or jagged due to moisture loss, cracking in the microstructure, and the incipient "split-line" features in dry bone.

Large carnivores such as hyenas are also capable of producing spiral fractures on long bones however (Lyman 1987, 1994; Binford 1981; Stiner 1994; Johnson 1989; Bunn 1989; Blumenschine & Marean 1993; Hill 1989). Since their presence has been identified in Level II/8 at Kabazi II and at the nearby rock shelter, Kabazi V (Burke 1999) it was necessary to employ further diagnostic criteria to ensure their proper identification. The location of a spiral fracture is useful in determining human agency since humans tend to fracture fresh bones at the mid-diaphysis, whereas spiral fractures generated by carnivores commonly occur at the epiphyses (Lyman 1987a; Blumenschine & Marean 1993; Gifford 1981).

The presence of "flake scars" generated through direct percussion, in combination with the location of the spiral fracture is critical point in identifying bone breakage resulting from butchering activities (Lyman 1987a, 1994; Binford 1981; Scott 1989; Fisher 1995).

For an example of a long bone exhibiting both flake-scarring and spiral fracturing see Appendix G (Image 2).

At first glance, flake scars may be confused with perforations and crush marks caused by carnivore teeth (Johnson 1989; Lyman 1994; Binford 1981; Stiner 1994; Bunn 1989; Hill 1989; Gifford 1981). According to Bunn (1989, 302-303), different sizes and shapes of hammer stones and, by extension, anvils may be a potential source of ambiguity when distinguishing between tooth marks and flake scars. For instance, a pointed hammer stone or anvil may generate similar perforations to those resulting from carnivore teeth. However, flake scars created on fresh bone generally exhibit conchoidal fractures (Fisher 1995; Lyman 1994; Gifford 1981).

The Identification of Burned Bone

Burned bone was identified at the macroscopic level only. The six color stages as well as the four texture stages described by Cain (2005, 875- Tables 1 & 2) were employed here.

The Assessment of Bone Weathering

The degree and characteristic of weathering were identified using plaster casts of bones exhibiting the 5 weathering stages defined by Behrensmeyer (1978). Behrensmeyer (1978, 152) states that in order to assign a weathering stage to a sample, the observer should record the most advanced stage which covers an area larger than 1 cm^2. Lyman and Fox (1989, 314) caution that this procedure could potentially mask other information regarding the formational history of an assemblage such as multiple exposures and reburial as well as minimal movement after deposition and partial burial may weather the upper surface of a bone more than the lower surface. In order to overcome this, all observed weathering stages were recorded in addition to the most dominant. For the qualitative descriptions of each weathering stage, see Behrensmeyer (1978, 151).

IV-Results

4.1-Level II/1

4.1.1- Sample Size

	Number of Samples	% of Total
Unidentified Fragments	325	69
NISP Remains Identified to the Level of Species	135	29
NISP Remains Identified to the Level of Class	13	2
Total	473	100
Proportion of Identified Remains	31%	-

Table 4.1.1a- Relative bone counts for mammal remains in Level II/1.

The unidentified portion of the assemblage from Level II/1 consists of 325 unidentified samples, 183 of which are bone fragments and 142 are tooth fragments of varying size classes.

4.1.2-Species Representation

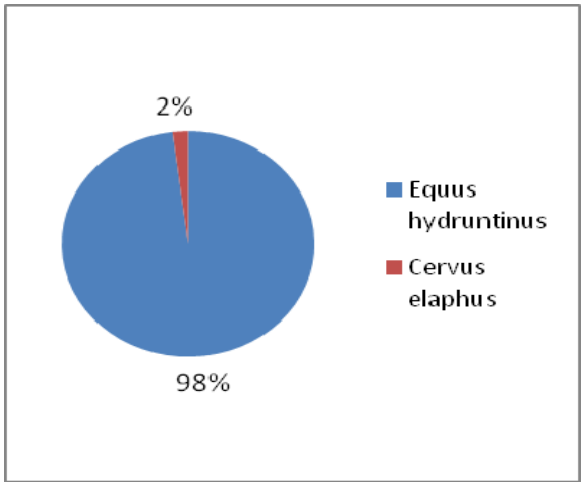


Figure 4.1.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/1.

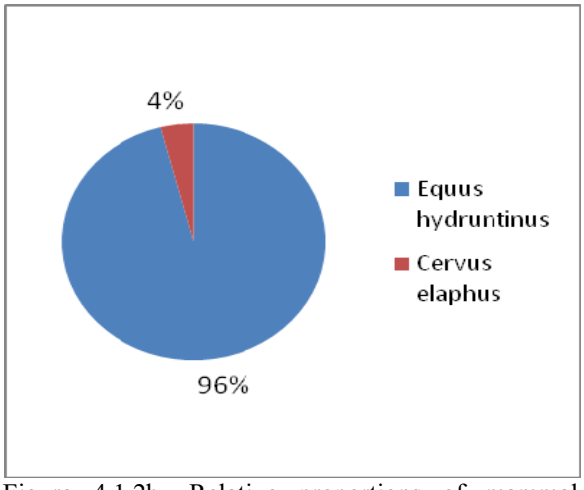


Figure 4.1.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/1.

MNI for *Equus hydruntinus* in Level II/1 is 8 individuals including: 1 juvenile aged 25-30 months, inferred on the basis of 3 upper deciduous teeth and 7 adults one of whom is around 4

years of age based on a burgeoning adult lower third incisor. The presence of the juvenile tentatively places the occupation of Level II/1 to between the mid summer and early winter.

MNI for red deer (*Cervus elaphus)* in Level II/1 is one.

4.1.3-Element Representation for the Remains of *Equus hydruntinus*

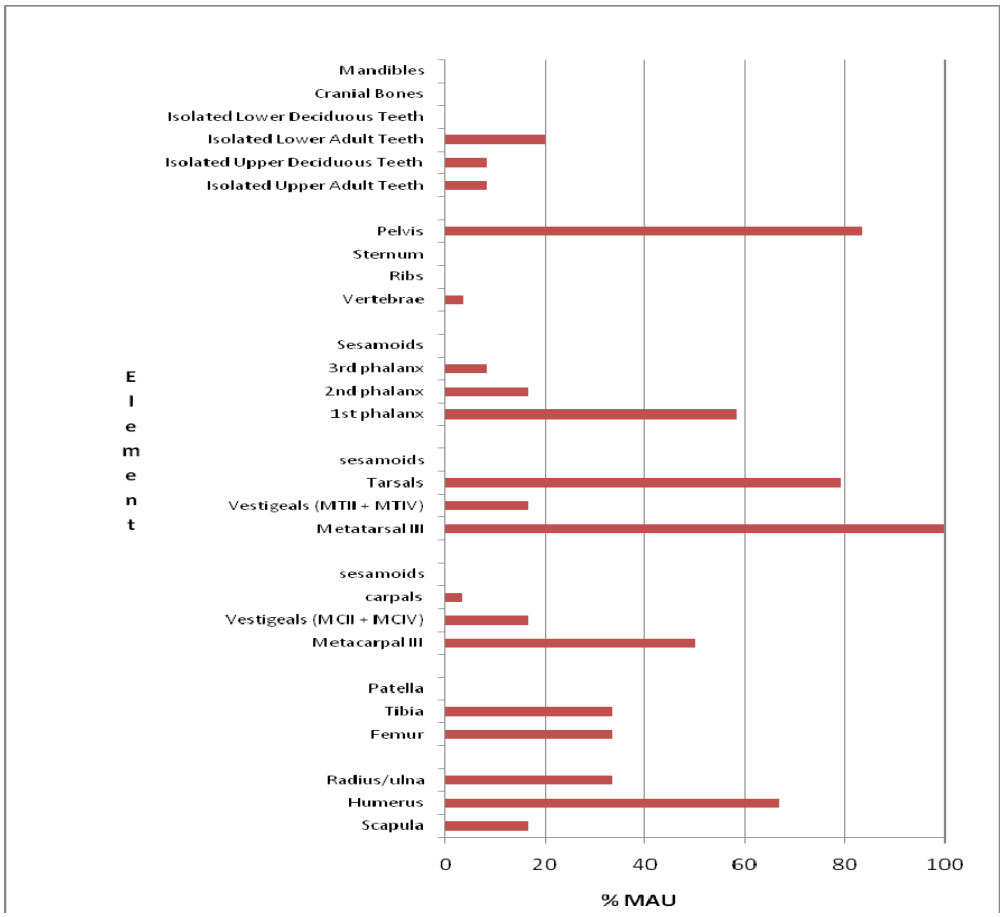


Figure 4.1.3a-Element representation among *Equus hydruntinus* remains in Level II/1.

According to Figure 4.1.3a, the *Equus hydruntinus* remains in Level II/1 are dominated by hind limbs. The upper front limbs are also fairly well represented. The axial skeleton is almost completely absent in Level II/1 with the exception of the pelvis.

4.1.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	1	1	Astralagus	Lateral surface	*Equus hydruntinus*
Burned	0	0	-	-	-
Flake Scars	0	0	-	-	-
Flake Scars with Spiral Fracturing	0	0	-	-	-
Total Samples	**148**	**100**			

Table 4.1.4a- Observed frequencies of anthropic surface modifications on identified remains in Level II/1.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	-	-	-	-
Polish	0	-	-	-	-
Spiral Fracturing	5	3	-	-	-
			Humerus	DDd	*Equus hydruntinus*
			Humerus	DDp	*Equus hydruntinus*
			Tibia	DDd	*Equus hydruntinus*
			Tibia	DDp	*Equus hydruntinus*
			Radius	DPd	*Equus hydruntinus*
Total Samples	**148**	**100**			

Table 4.1.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/1.

The only evidence for human activity comes in the form of cut marks on one sample (Table 4.1.4a).

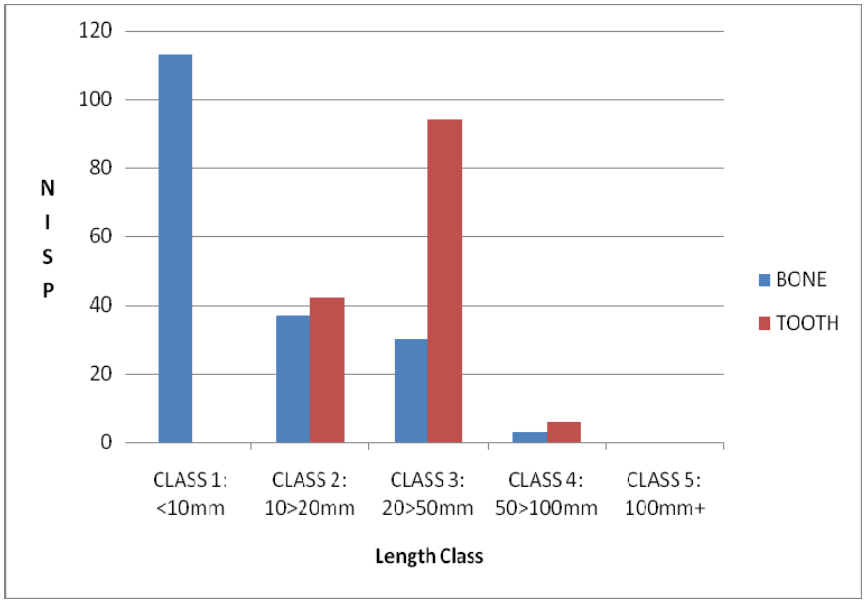


Figure 4.1.4- Relative proportions of length classes for the unidentified fragments in Level II/1.

		Cases Observed	% Cases Observed
Root Etching	P-	**4**	**2**
	P	**8**	**4**
	P+	**3**	**2**
	Sub Total	**15**	**8**
Abrasion		**0**	**-**
Weathering Stage	1	**0**	**0**
	2	**20**	**11**
	3	**67**	**36**
	4	**9**	**5**
	5	**0**	**0**
	Sub Total	**96**	**52**
Dissolution	P-	**43**	**24**
	P	**23**	**12**
	P+	**3**	**2**
	Sub Total	**69**	**38**
Manganese Oxide Staining		**4**	**2**
Total # of Occurrences		**184**	**100**

Table 4.1.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/1.

In general, the surfaces of the faunal remains in Level II/1 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.1.5- Element Representation and the Treatment of *Equus hydruntinus*

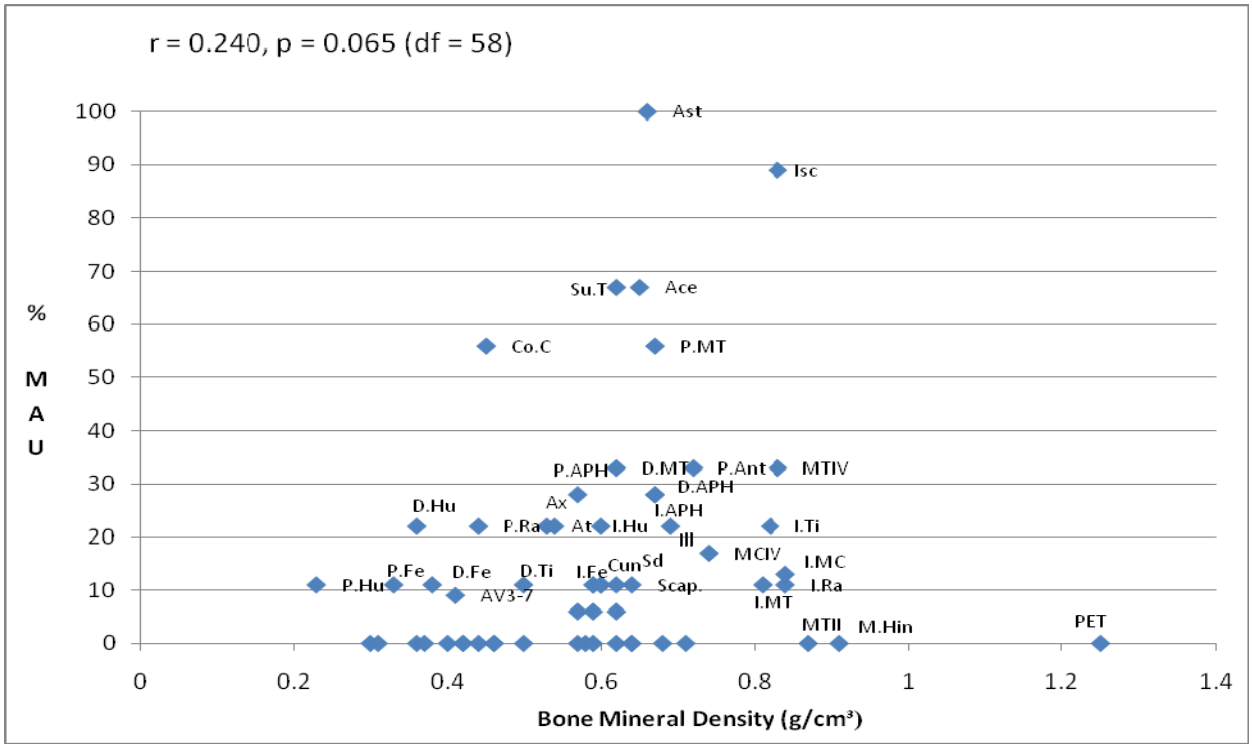


Figure 4.1.5a- Relation between mineral density and element representation for the remains of *Equus hydruntinus* in Level II/1.

The relation between element representation and bone mineral density is not significant.

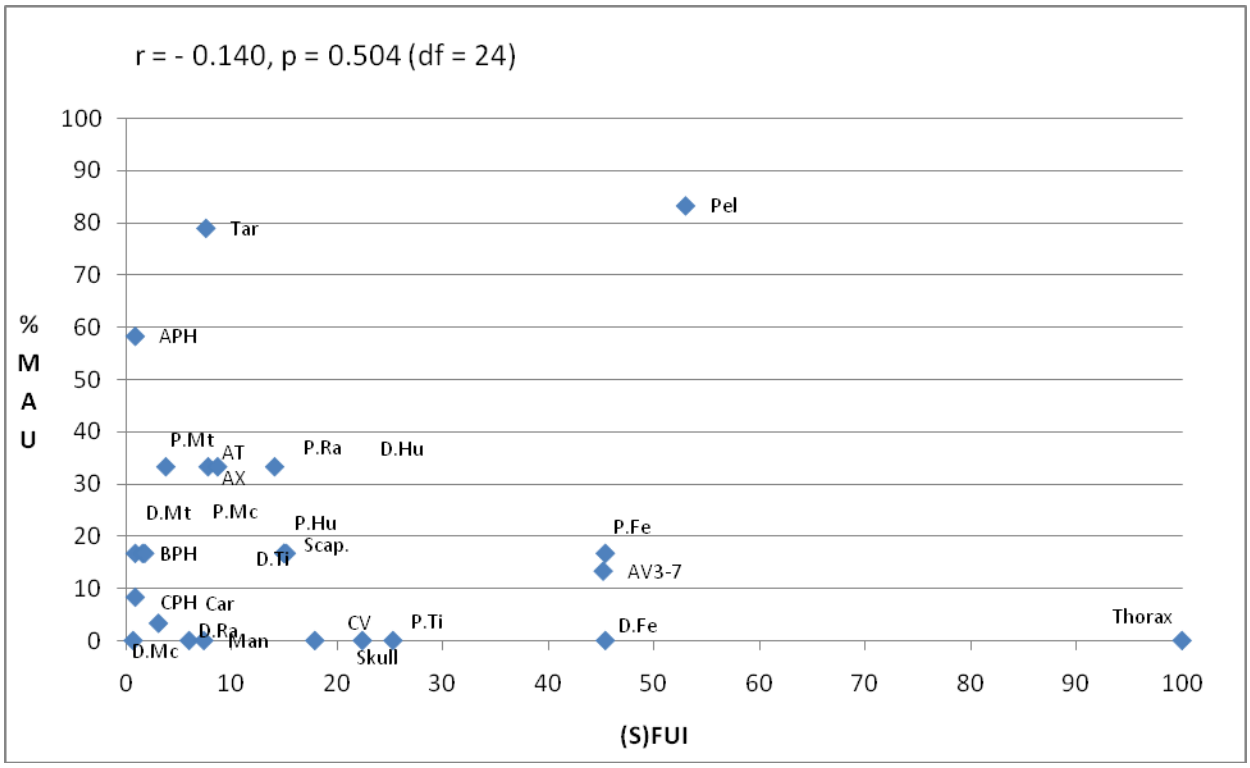


Figure 4.1.5b- Relation between element representation and their associated food values (SFUI) for the remains of *Equus hydruntinus* in Level II/1.

The relation between element representation and associated food value (SFUI) is not significant.

4.2-Level II/2-1

4.2.1- Sample Size

	Number of samples	% of Total
Unidentified Fragments	215	71
NISP Remains Identified to the Level of Species	83	27
NISP Remains Identified to the Level of Class	4	2
Total	301	100
Proportion of Identified Remains	28%	

Table 4.2.1a- Relative bone counts for mammal remains in Level II/2-1.

The unidentified portion of the assemblage from Level II/2-1 consists of 215 unidentified samples, 127 of which are bone fragments and 88 are tooth fragments of varying size classes.

4.2.2-Species Representation

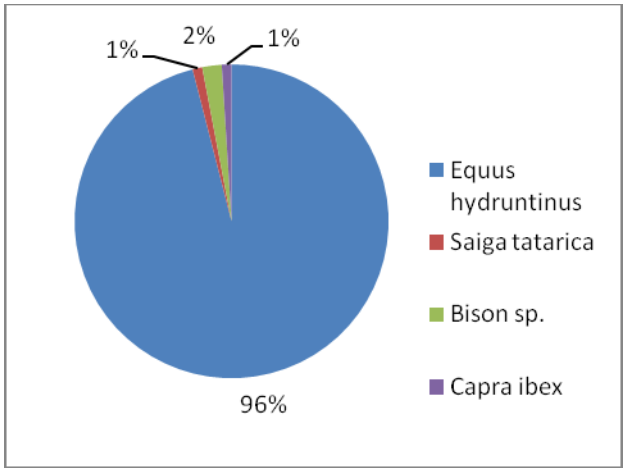


Figure 4.2.2a- Relative proportions of identified mammal species based on identified remains (% NISP) in Level II/2-1.

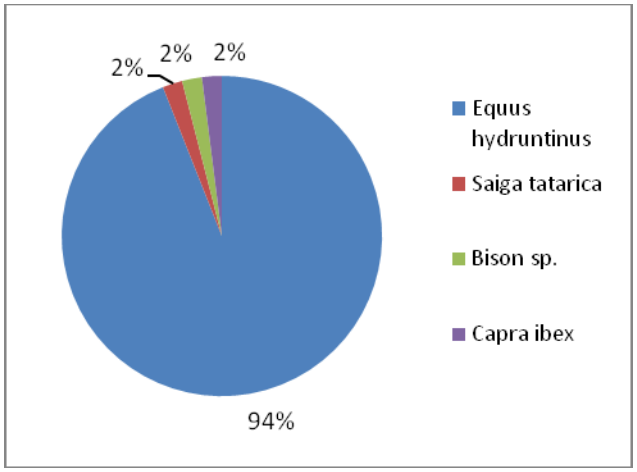


Figure 4.2.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/2-1.

MNI for *Equus hydruntinus* in Level II/2-1 is 3 adults (MNI) of unknown age. As a result, the season during which Level II/2-1 was occupied is unknown.

The remains of saiga antelope (*Saiga tatarica*), bison (cf. *priscus*), and ibex (*Capra ibex*) in Level II/2-1 are representative of one individual (MNI) in each case.

4.2.3-Element Representation for the Remains of *Equus hydruntinus*

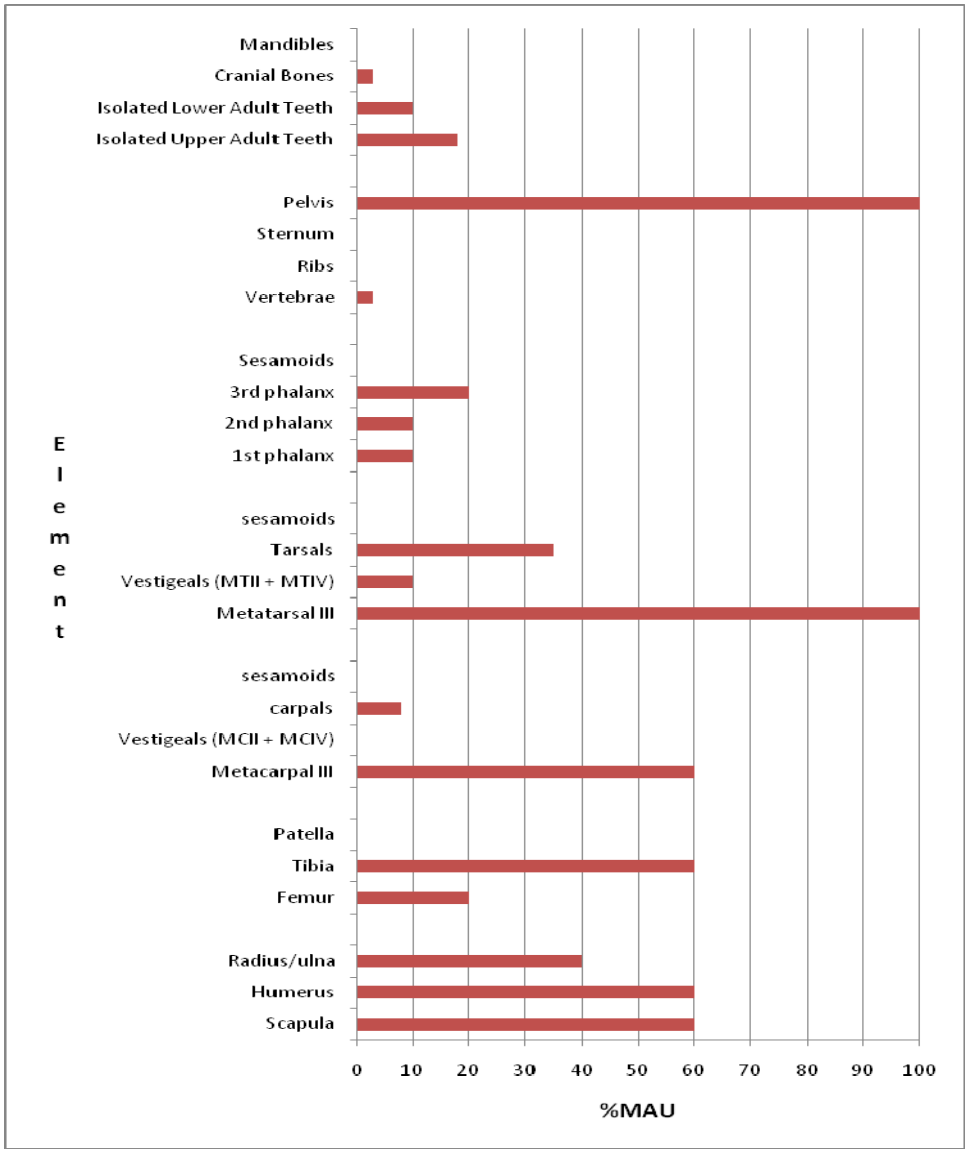


Figure 4.2.3a- Element representation among the *Equus hydruntinus* remains in Level II/2-1.

According to Figure 4.2.3a, the *Equus hydruntinus* remains in Level II/2-1 are dominated by the pelvis, the front limbs, and lower hind limbs. Elements of the axial skeleton are absent with the exception of the pelvis.

4.2.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	0	0	-	-	-
Burned	0	0	-	-	-
Flake Scars	0	0	-	-	-
Flake Scars with Spiral Fracturing	4	5			
			Metacarpal	DDP,DDd	*Equus hydruntinus*
			Tibia	DPp,DPd	*Equus hydruntinus*
			Metacarpal	DDp	*Equus hydruntinus*
			Metatarsal	DPp	*Equus hydruntinus*
Total Samples	**87**	**100**			

Table 4.2.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/2-1.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	-			
Polish	0	-			
Spiral Fracturing	12	14			
			Metacarpal	DDP,DDd	*Equus hydruntinus*
			Tibia	EP,DPp,DPd	*Equus hydruntinus*
			Metacarpal	DDp	*Equus hydruntinus*
			Metatarsal	EP, DPp	*Equus hydruntinus*
			Metacarpal	DDd, ED	*Equus hydruntinus*
			Metatarsal	DDd, ED	*Equus hydruntinus*
			Tibia	DPp	*Equus hydruntinus*
			Humerus	DPd, DM, DDP	*Equus hydruntinus*
			Tibia	DPp	*Equus hydruntinus*
			Tibia	DPp	*Equus hydruntinus*
			Metacarpal	EP, DPp	*Equus hydruntinus*
			Femur	DDd	*Equus hydruntinus*
Total Samples	**87**	**100**			

Table 4.2.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/2-1.

Evidence of human activity comes in the form of flake scarring and spiral fracturing (Table 4.2.4a).

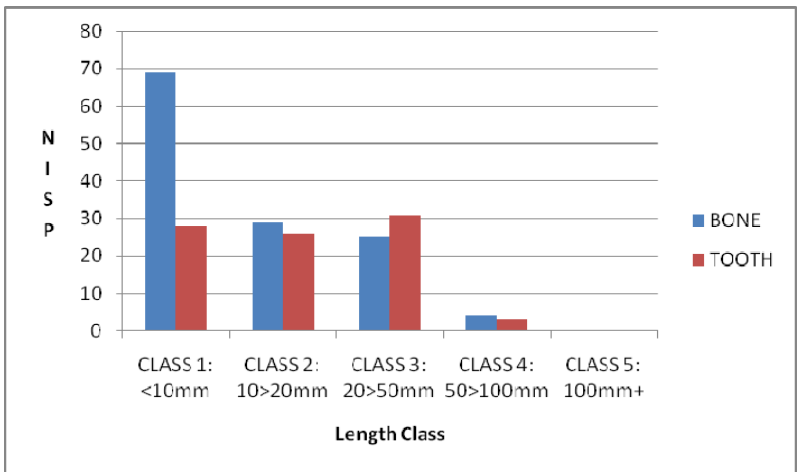


Figure 4.2.4- Relative proportions of length classes for the unidentified fragments in Level II/2-1.

		Cases Observed	% Cases Observed
Root Etching	P-	**8**	**7**
	P	**1**	**1**
	P+	**0**	**0**
	Sub Total	**9**	**8**
Abrasion		**2**	**2**
Weathering Stage	1	**8**	**7**
	2	**9**	**8**
	3	**43**	**39**
	4	**0**	**0**
	5	**0**	**0**
	Sub Total	**60**	**55**
Dissolution	P-	**22**	**20**
	P	**12**	**11**
	P+	**2**	**2**
	Sub Total	**36**	**33**
Manganese Oxide Staining		**2**	**2**
Total # of Occurrences		**107**	**-**

Table 4.2.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/2-1.

In general, the surfaces of the faunal remains in Level II/2-1 are poorly preserved as indicated by the high degree of weathering and dissolution.

4.2.5- Element Representation and the Treatment of *Equus hydruntinus*

Unfortunately, assessments of density mediated destruction and selective transport could not be undertaken for Level II/2-1 due to small sample size.

4.3-Level II/2

4.3.1- Sample Size

	Number of samples	% of Total
Unidentified Fragments	205	51
NISP Remains Identified to the Level of Species	181	45
NISP Remains Identified to the Level of Class	14	4
Total	400	100
Proportion of Identified Remains	49%	-

Table 4.3.1a- Relative bone counts for mammal remains in Level II/2.

The unidentified portion of the assemblage from Level II/2 consists of 205 unidentified samples, 98 of which are bone fragments and 107 are tooth fragments of varying size classes.

4.3.2-Species Representation

Equus hydruntinus is the only species identified in Level II/2. Their remains are representative of 11 individuals; 9 adults, 1 yearling based on a completely unfused proximal 1st phalanx, and 1 juvenile aged 25-32 months on the basis of three deciduous teeth. The age of the juvenile places the occupation of level II/2 between the mid-summer and early winter.

4.3.3-Element Representation for the Remains of *Equus hydruntinus*

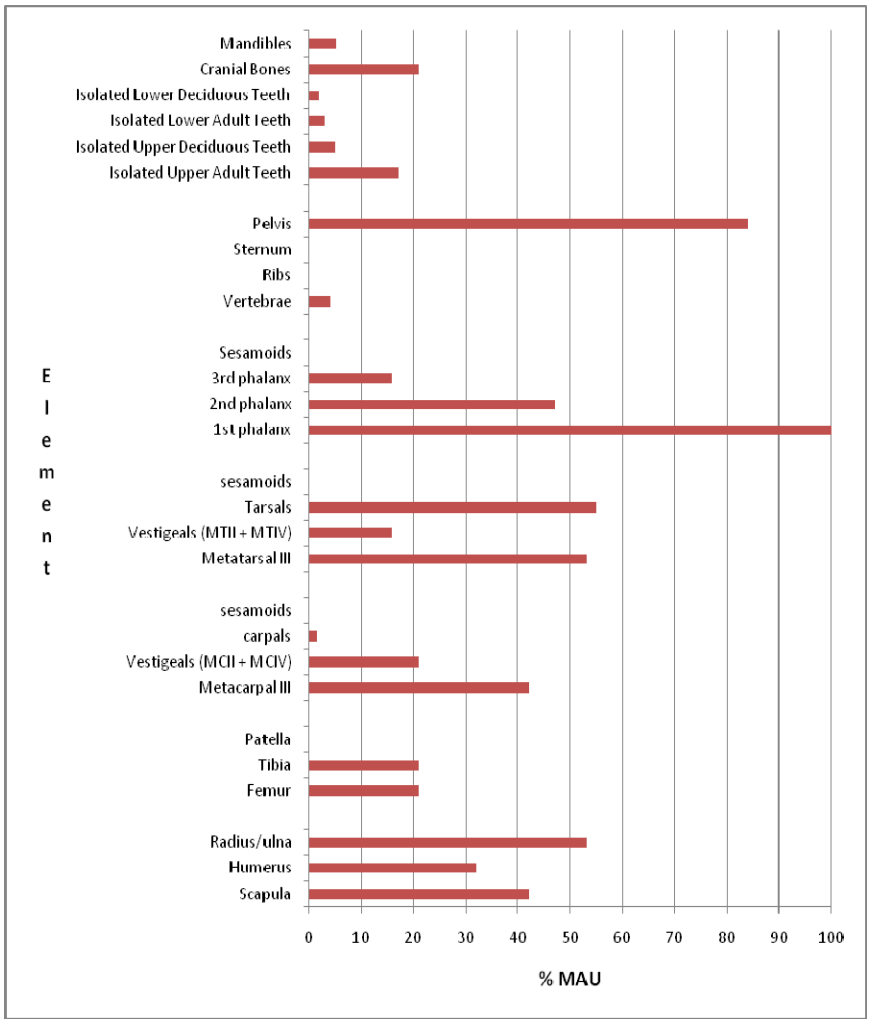


Figure 4.3.3a- Element representation among the *Equus hydruntinus* remains in II/2.

According to Figure 4.3.3a, the *Equus hydruntinus* remains in Level II/2 are dominated by the pelvis, the upper front limbs, and extremities. The lower hind limbs are also fairly well represented. Elements of the axial skeleton are mostly absent with the exception of pelvis.

4.3.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	0	0	-	-	-
Burned	4*	2	Unidentified	Unidentified	Large mammal
Flake Scars	0	0	-	-	-
Flake Scars with Spiral Fracturing	0	0	-	-	-
Total Samples	**195**	**100**			

Table 4.3.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/2.

*All 4 fragments burned to stage 2.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	1	1	Astralagus		*Equus hydruntinus*
Polish	0	0			
Spiral Fracturing	11	6			
			Radius	DPd,DM	*Equus hydruntinus*
			Metatarsal	ED	*Equus hydruntinus*
			Metatarsal	ED	*Equus hydruntinus*
			Metacarpal	EP,DPp	*Equus hydruntinus*
			Metatarsal	DPp,DPd,DM	Large Artiodactyl
			Radius	DPd,DM,DDp	Small Artiodactyl
			Radius	DPd,DM	*Equus hydruntinus*
			Humerus	DDp,DDd	*Equus hydruntinus*
			Humerus	DPp,DPd,DM	*Equus hydruntinus*
			Humerus	ED	*Equus hydruntinus*
			Humerus	ED	*Equus hydruntinus*
Total Samples	**195**	**100**			

Table 4.3.4b-Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/2.

The presence of gnaw marks on 1 sample (Table 4.3.4b) implies that the role of carnivores in the formation of the assemblage from Level II/2 cannot be ignored. Furthermore,

there is some direct evidence of human activity in the form of combustion (Table 4.3.4a) which suggests that Level II/2 represents a mixed assemblage.

The Effects of Plants, Climate, and Diagenesis

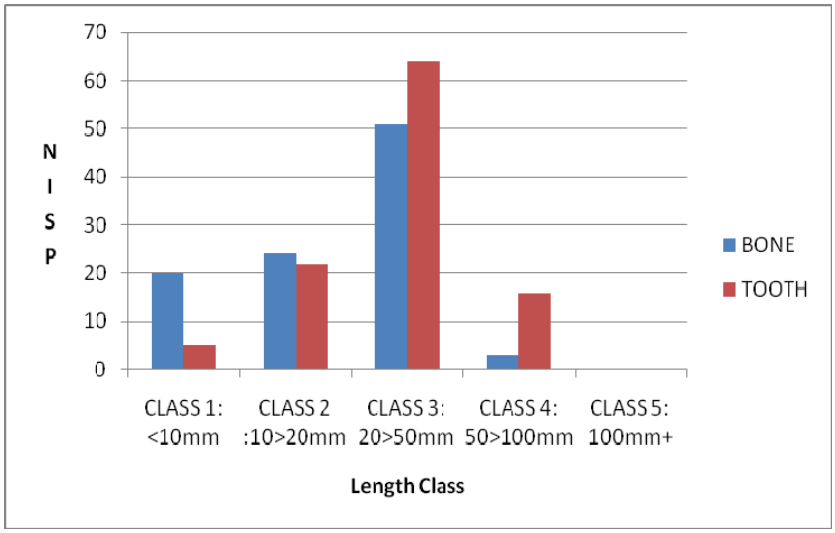


Figure 4.3.4- Relative proportions of length classes for the unidentified fragments in Level II/2.

		Cases Observed	% Cases Observed
Root Etching	P-	**12**	**5**
	P	**16**	**7**
	P+	**6**	**2**
	Sub Total	**34**	**14**
Abrasion		**0**	**0**
Weathering Stage	1	**0**	**0**
	2	**12**	**5**
	3	**96**	**39**
	4	**1**	**1**
	5	**0**	**0**
	Sub Total	**109**	**45**
Dissolution	P-	**68**	**29**
	P	**23**	**9**
	P+	**7**	**3**
	Sub Total	**98**	**41**
Manganese Oxide Staining		**3**	**3**
Total # of Occurrences		**244**	

Table 4.3.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/2.

In general, the surfaces of the faunal remains in Level II/2 are poorly preserved as demonstrated by the high degree of weathering and dissolution. However the assemblage from Level II/2 appears to be less fragmentary than others in this unit.

4.3.5- Element Representation and the Treatment of *Equus hydruntinus*

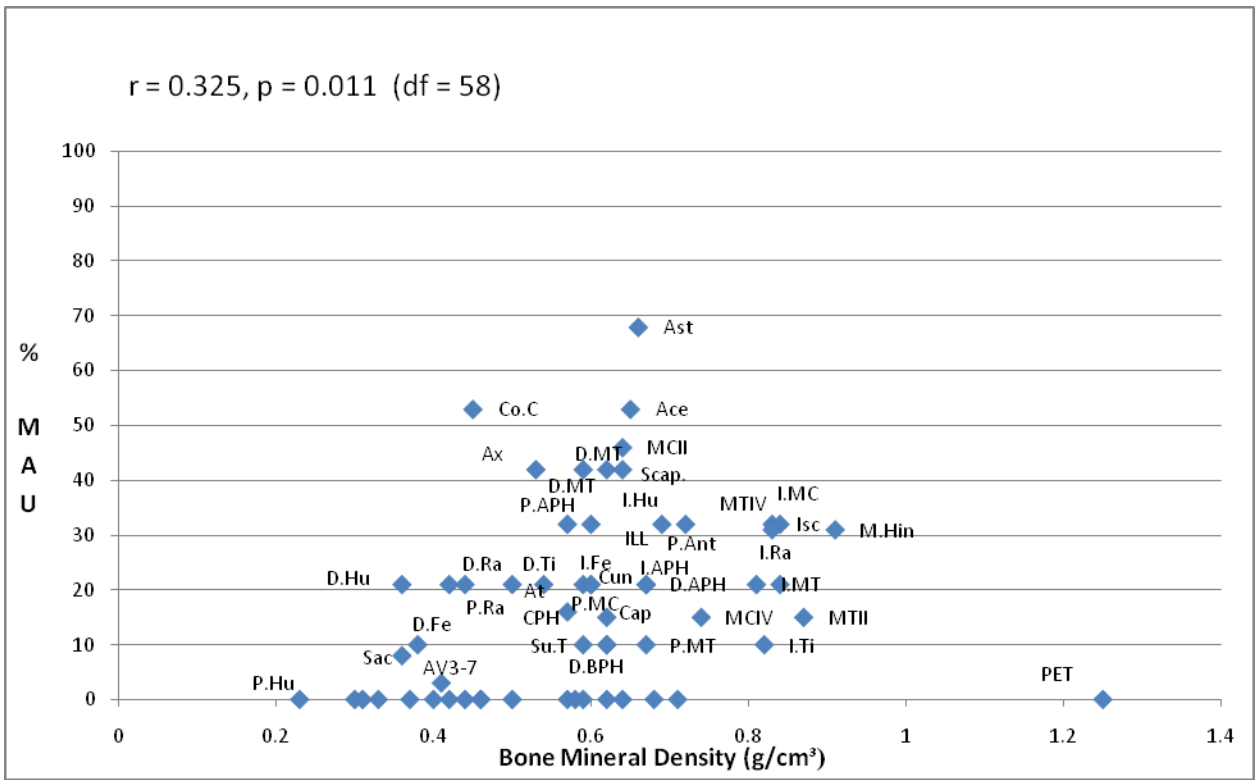


Figure 4.3.5a- Relation between mineral density and element representaton for the remains of *Equus hydruntinus* in Level II/2.

A significant positive relation exists between element representation and mineral density indicating that *in situ* destruction of lower density elements has occurred.

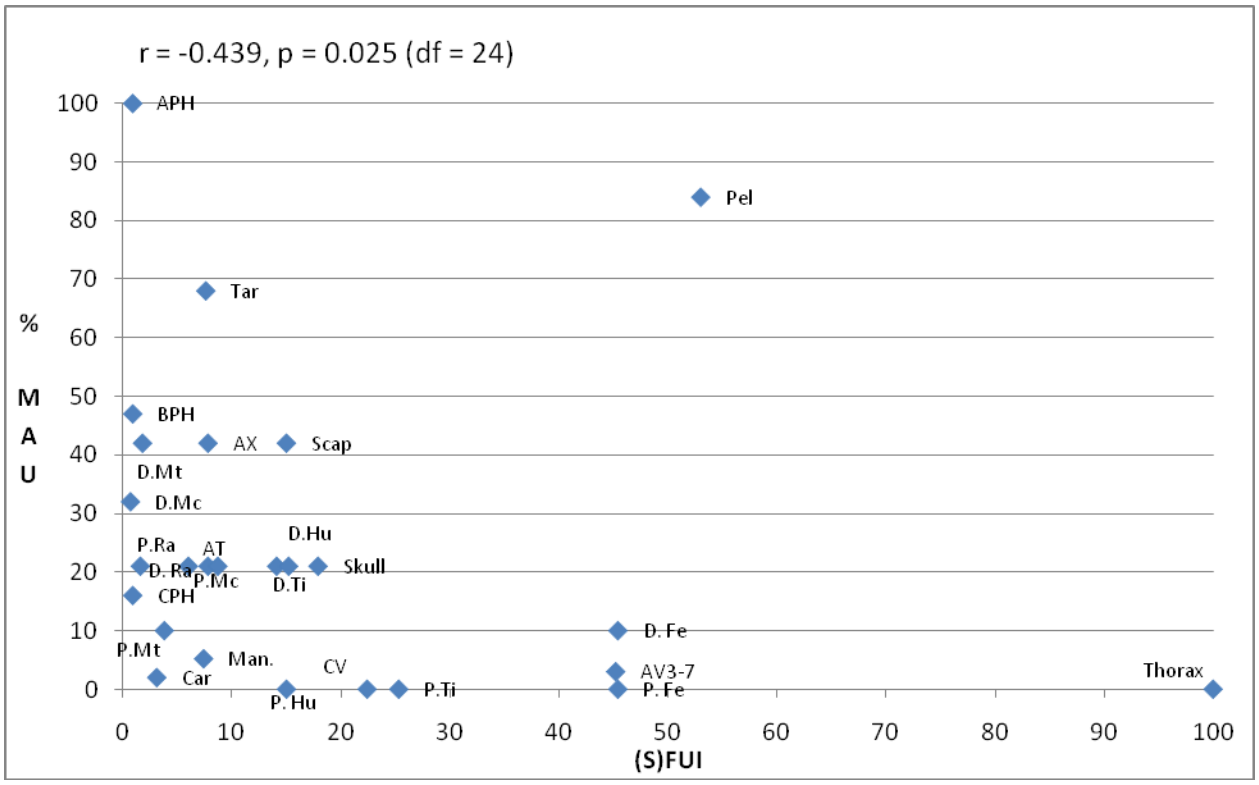


Figure 4.3.5b- Relation between element representation and their associated food values (SFUI) for the remains of *Equus hydruntinus* in Level II/2.

There is a significant negative relationship between element representation and associated food value (SFUI) suggesting that some elements with high SFUI values were transported off site to another location. This is consistent with the fragmentation values and would indicate that during the formation of Level II/2 Kabazi II served as a kill and butchery site however these results are likely influenced by *in situ* destruction of lower density elements (Figure 4.3.5a).

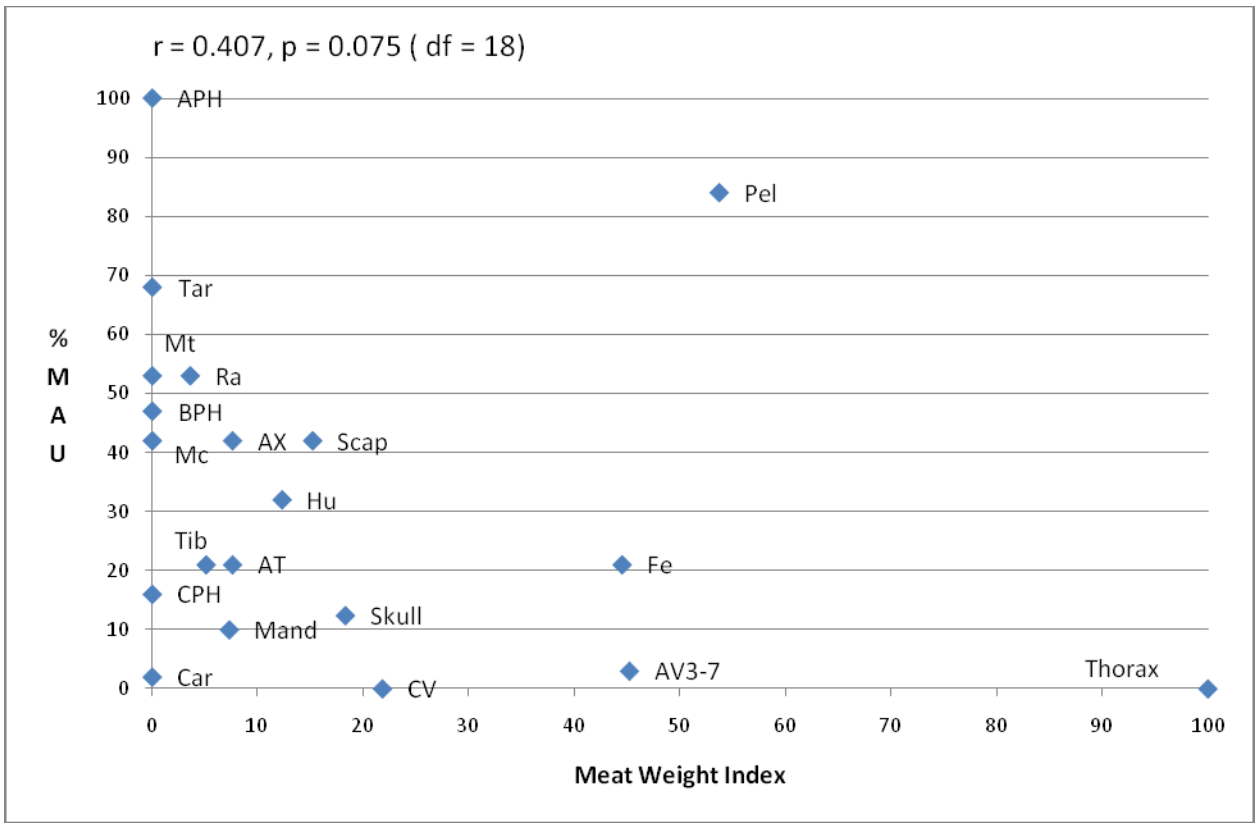


Figure 4.3.5c- Relation between element abundance and meat weight index for the remians of *Equus hydruntinus* in Level II/2.

The relation between element representation and meat weight index is not significant.

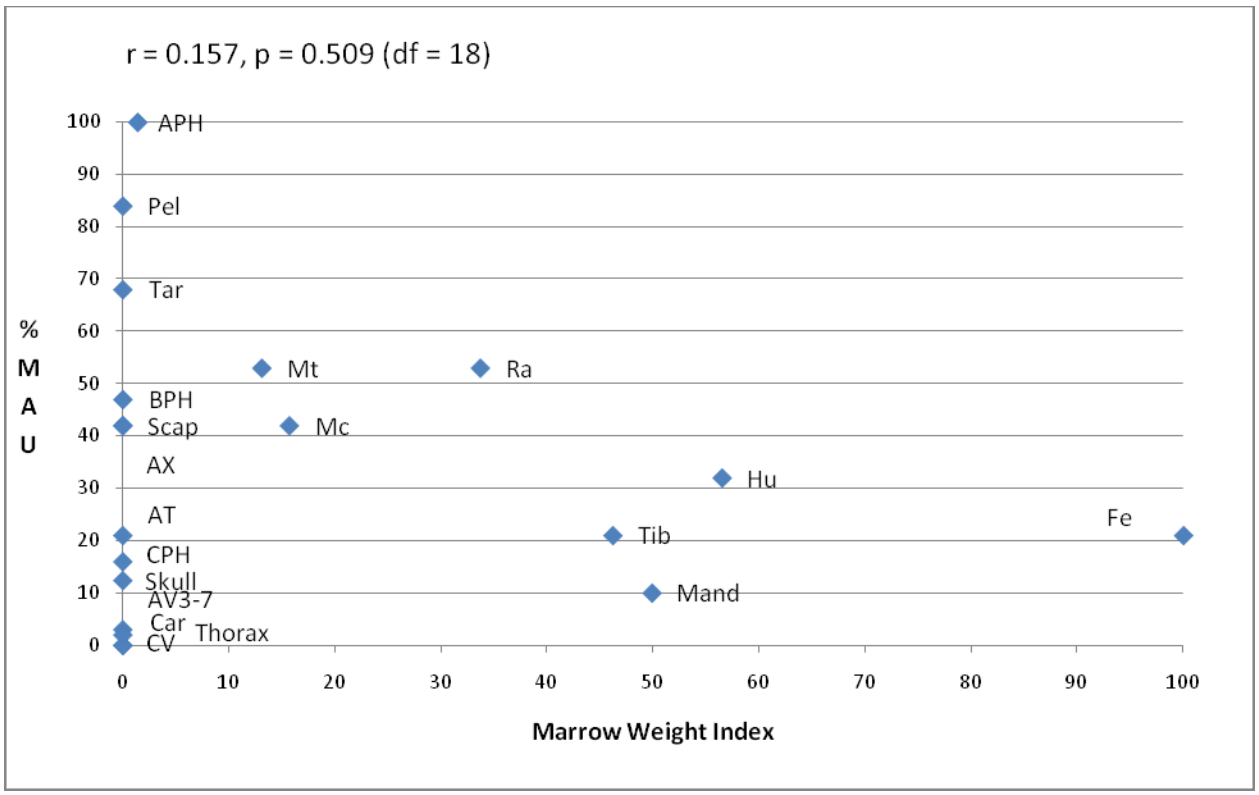


Figure 4.3.5d- Relation between element abundance marrow weight index for the remains of *Equus hydruntinus* in Level II/2.

The relation between element representation and marrow weight index is not significant.

4.4-Level II/3

4.4.1- Sample Size

	Number of samples	% of Total
Unidentified Fragments	328	60
NISP Remains Identified to the Level of Species	207	37
NISP Remains Identified to the Level of Class	15	3
Total	552	100
Proportion of Identified Remains	40%	

Table 4.4.1a- Relative bone counts for mammal remains in Level II/3.

The unidentified portion of the assemblage from Level II/3 consists of 328 samples, 76 of which are bone fragments and 252 are tooth fragments of varying size classes.

4.4.2-Species Representation

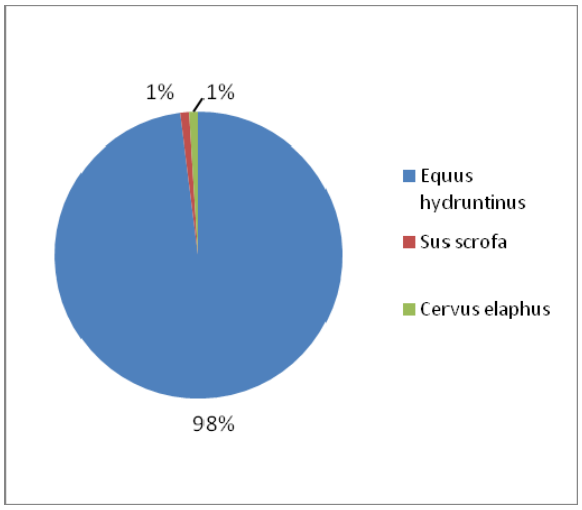


Figure 4.4.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/3.

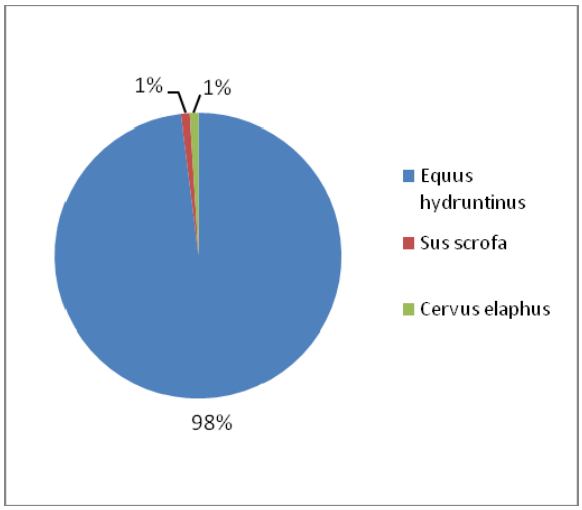


Figure 4.4.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/3.

MNI for *Equus hydruntinus* in Level II/3 is 7 individuals; 1 juvenile aged 25-30 months and 1 yearling based on a completely unfused distal radius. The remainder represents 5 adults including 1 male aged 3-3.5 years on the basis of a burgeoning canine tooth. The presence of the juvenile places the occupation of Level II/3 between mid-summer and late winter.

MNI for red deer (*Cervus elaphus)* and wild pig (*Sus scrofa)* in Level II/3 is one.

4.4.3-Element Representation for the Remains of *Equus hydruntinus*

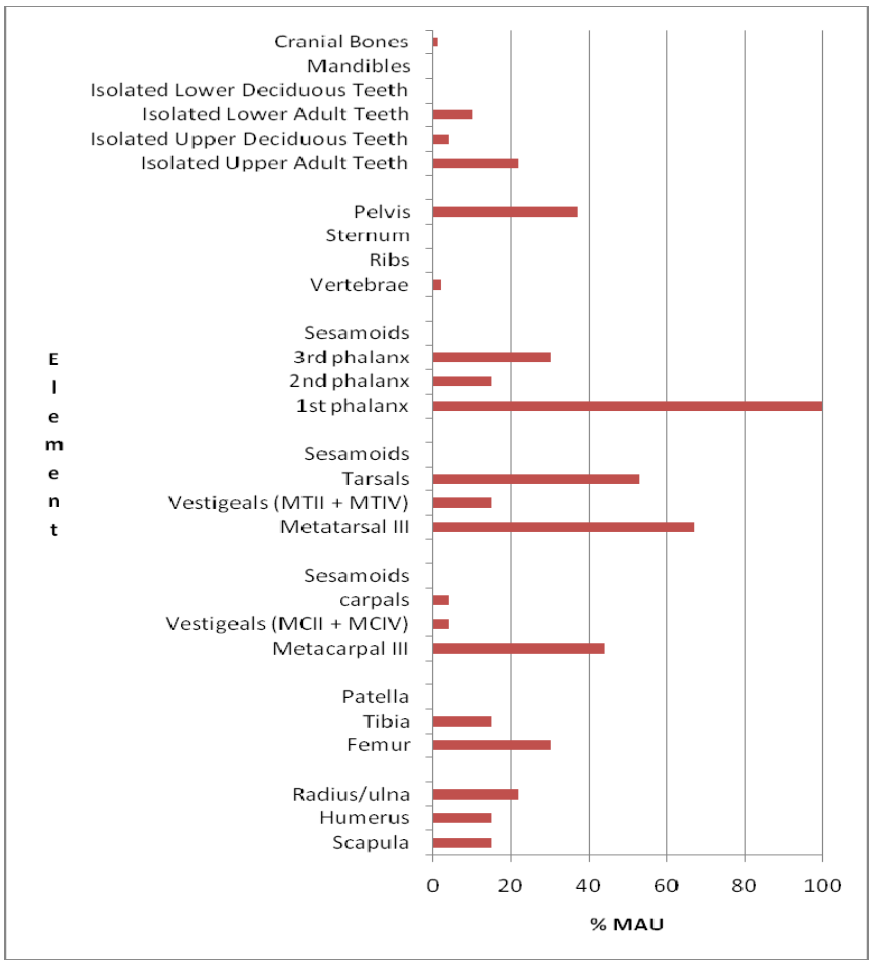


Figure 4.4.3a- Element representation among the *Equus hydruntinus* remains in II/3.

According to Figure 4.4.3a, the *Equus hydruntinus* remains in Level II/3 are dominated by the podial extremities and elements of the axial skeleton are largely absent with the exception of the pelvis.

4.4.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	0	0	-	-	-
Burned	18*	7			1 *Equus hydruntinus*
					17 Large Mammal
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	0	0			
Total Samples	**221**	**100**			

Table 4.4.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/3.

*8 samples burned to stage 2; 8 samples burned to stage 3.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	0	-	-	-
Polish	0	0	-	-	-
Spiral Fracturing	6	3	Femur	DDd	*Equus hydruntinus*
			Femur	DDd	*Equus hydruntinus*
			Tibia	DPp,DPd	*Equus hydruntinus*
			Metatarsal	DPp,DPd	*Equus hydruntinus*
			Metacarpal	DDp,DDd	*Equus hydruntinus*
			Metacarpal	DDp,DDd,ED	*Equus hydruntinus*
Total Samples	**221**	**100**			

Table 4.4.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/3.

Evidence of human activity in Level II/3 comes in the form of combustion (Table 4.4.4a).

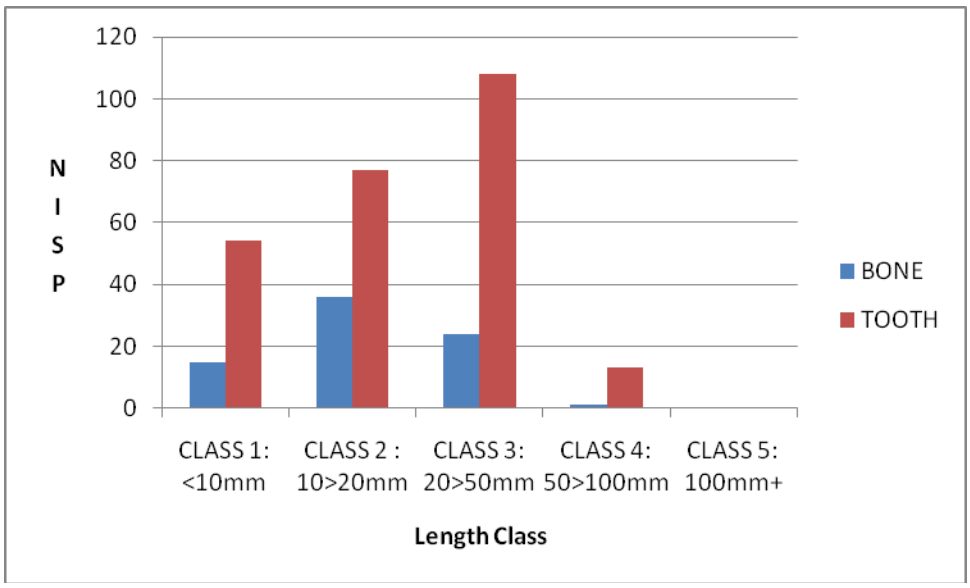


Figure 4.4.4- Relative proportions of length classes for the unidentified fragments in Level II/3.

		Cases Observed	% Cases Observed
Root Etching	P-	**2**	**1**
	P	**4**	**2**
	P+	**3**	**1**
	Sub Total	**9**	**4**
Abrasion		**0**	**0**
Weathering Stage	1	**0**	**0**
	2	**14**	**6**
	3	**122**	**57**
	4	**0**	**0**
	5	**0**	**0**
	Sub Total	**136**	**63**
Dissolution	P-	**50**	**23**
	P	**9**	**4**
	P+	**9**	**4**
	Sub Total	**68**	**31**
Manganese Oxide Staining		**1**	**1**
Total # of Occurrences		**214**	

Table 4.4.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/3.

In general, the surfaces of the faunal remains in Level II/3 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.4.5- Element Representation and the Treatment of *Equus hydruntinus*

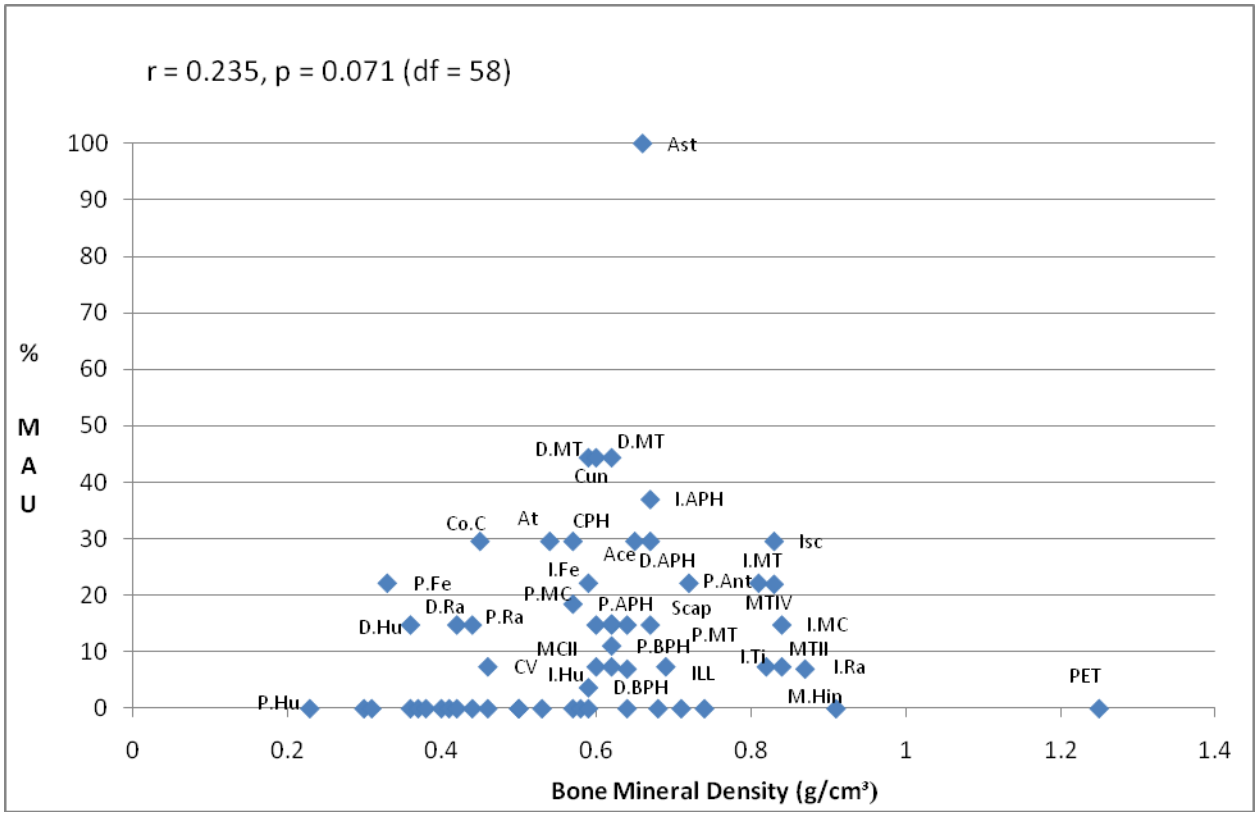


Figure 4.4.5a- Relation between mineral density and element representation for the remains of *Equus hydruntinus* in Level II/3.

The relation between element representation and mineral density is not significant.

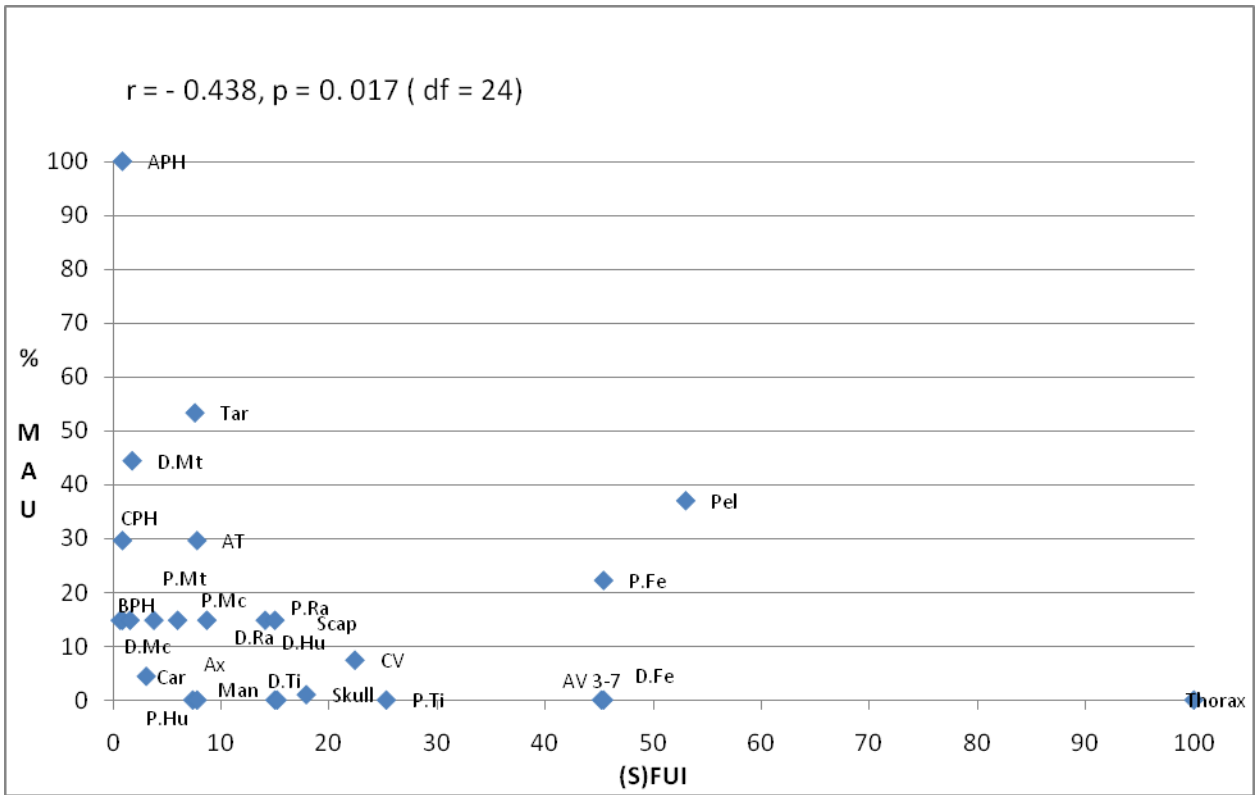


Figure 4.4.5b- Relation between element representation and their associated food values (SFUI) for the remains of *Equus hydruntinus* in Level II/3.

There is a significant negative relation between element representation and associated food values (SFUI) indicating that elements with a high SFUI values were carried off site to a different location.

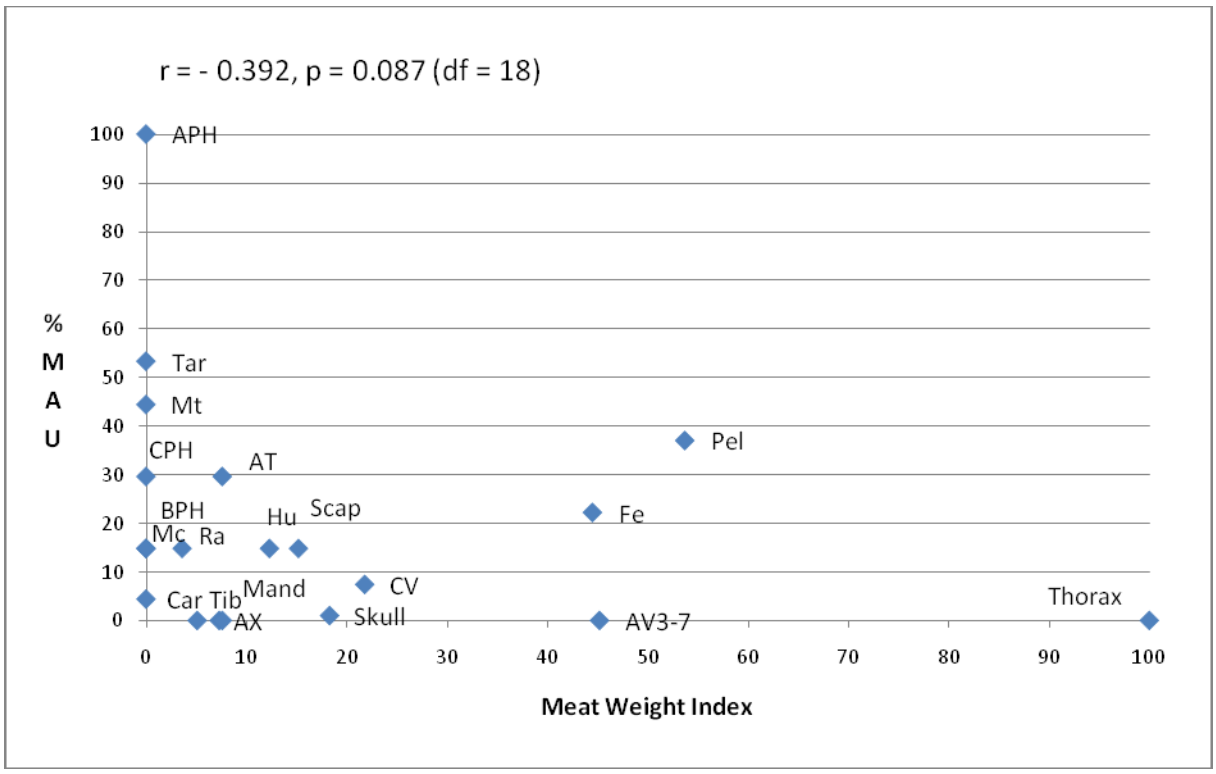


Figure 4.4.5c- Relation between element abundance and meat weight values for the remains of *Equus hydruntinus* in Level II/3.

The relation between element representation and associated meat weight index is not significant.

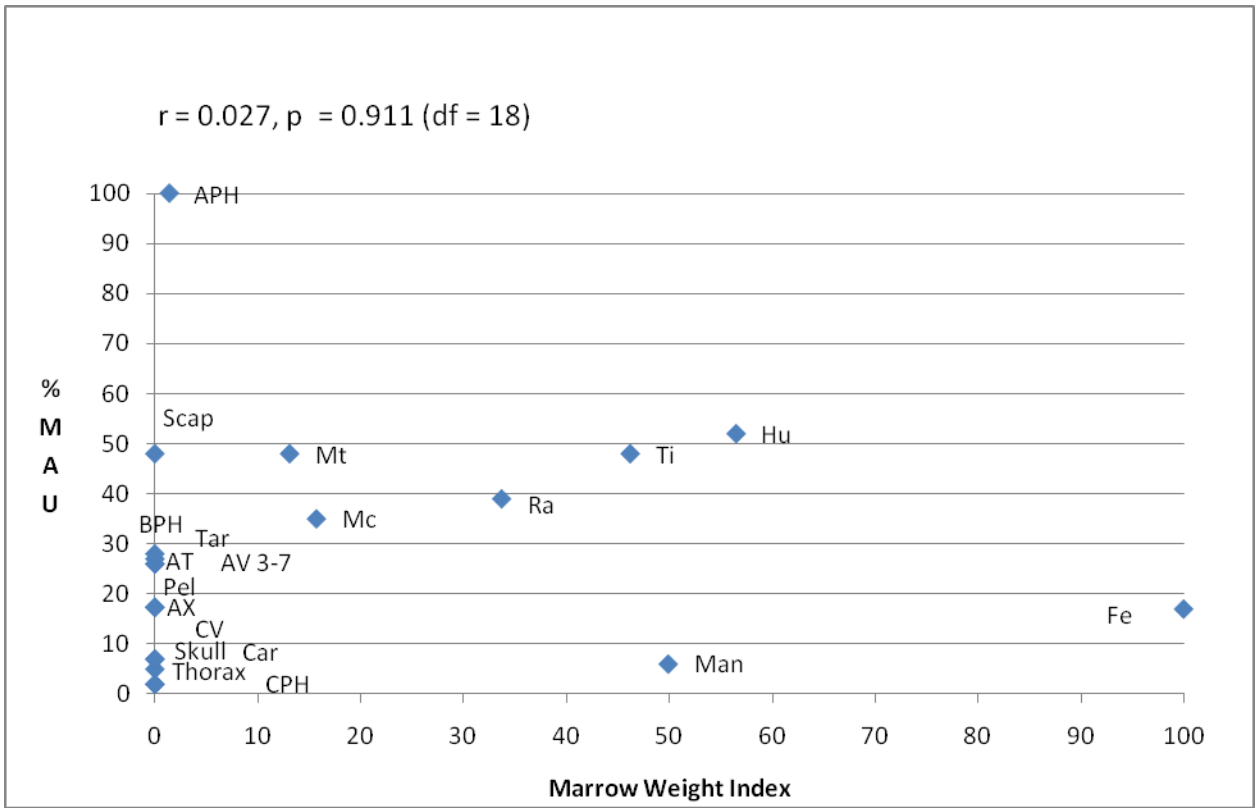


Figure 4.4.5d- Relation between element abundance and marrow weight index for the remains of *Equus hydruntinus* in Level II/3.

The relation between element representation and marrow weight index is not significant.

4.5-Level II/4

4.5.1-Sample Size

	Number of samples	% Total Sample
Unidentified Fragments	294	90
NISP Remains Identified to the Level of Species	34	10
NISP Remains Identified to the Level of Class	0	0
Total	**328**	100
Proportion of Identified Remains	**10%**	

Table 4.5.1a- Relative bone counts for mammal remains in Level II/4.

In Level II/4, 98% of identified and unidentified remains are teeth. These represent a portion of the assemblage that had been separated from the bones during post-excavation sorting.

Nevertheless, the teeth from Level II/4 do provide some useful data regarding age and seasonality (below).

4.5.2-Species Representation

The only species identified in Level II/4 is *Equus hydruntinus* whose remains represent 4 individuals-1 juvenile aged 25-32 months and 3 adults, 1 aged 3.5 to 5 years. The presence of the juvenile places the occupation of Level II/4 between the summer or mid-winter.

Given lack of osseous remains in Level II/4 further assessments cannot be undertaken.

4.6-Level II/5

4.6.1-Sample Size

	Number of samples	% Total Sample
Unidentified Fragments	378	75
NISP Remains Identified to the Level of Species	115	23
NISP Remains Identified to the Level of Class	6	1
Total	498	100
Proportion of Identified Remains	24%	-

Table 4.6.1a-Relative bone counts for mammal remains in Level II/5.

The unidentified portion of the assemblage from Level II/5 consists of 378 unidentified samples, 137 of which are bone fragments and 241 are tooth fragments of varying size classes.

4.6.2-Species Representation

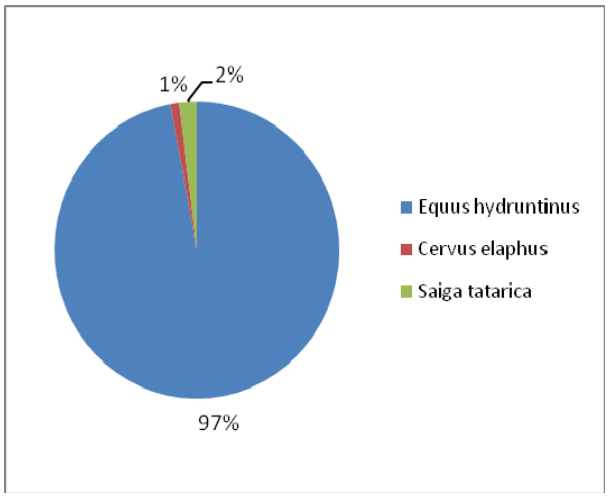


Figure 4.6.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/5.

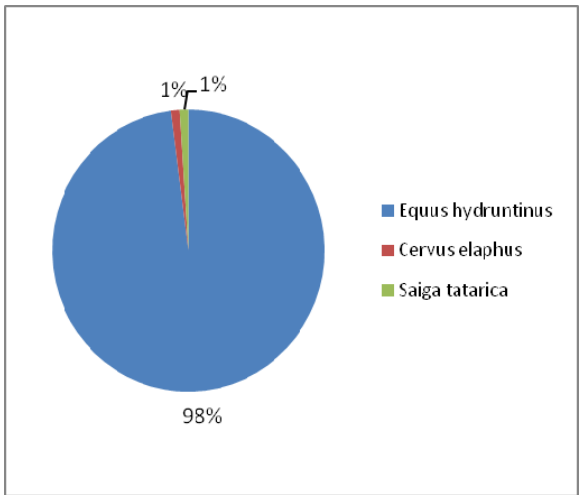


Figure 4.6.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/5.

MNI for *Equus hydruntinus* in Level II/5 is 13 individuals- 2 juveniles; 1 aged 25-30 months and 1 aged 10-20 months. The remainder, are representative of 11 adults, including 1 aged 3.5-5 years. The presence of the juvenile aged 25-30 months places the occupation of Level II/5 between mid summer and early winter. The juvenile aged 10-20 months adds the possibility this occupation may have extended into the early spring.

MNI for red deer (*Cervus elaphus)* and saiga antelope (*Saiga tatarica)* in Level II/5 is one.

4.6.3- Element Representation for the Remains of *Equus hydruntinus*

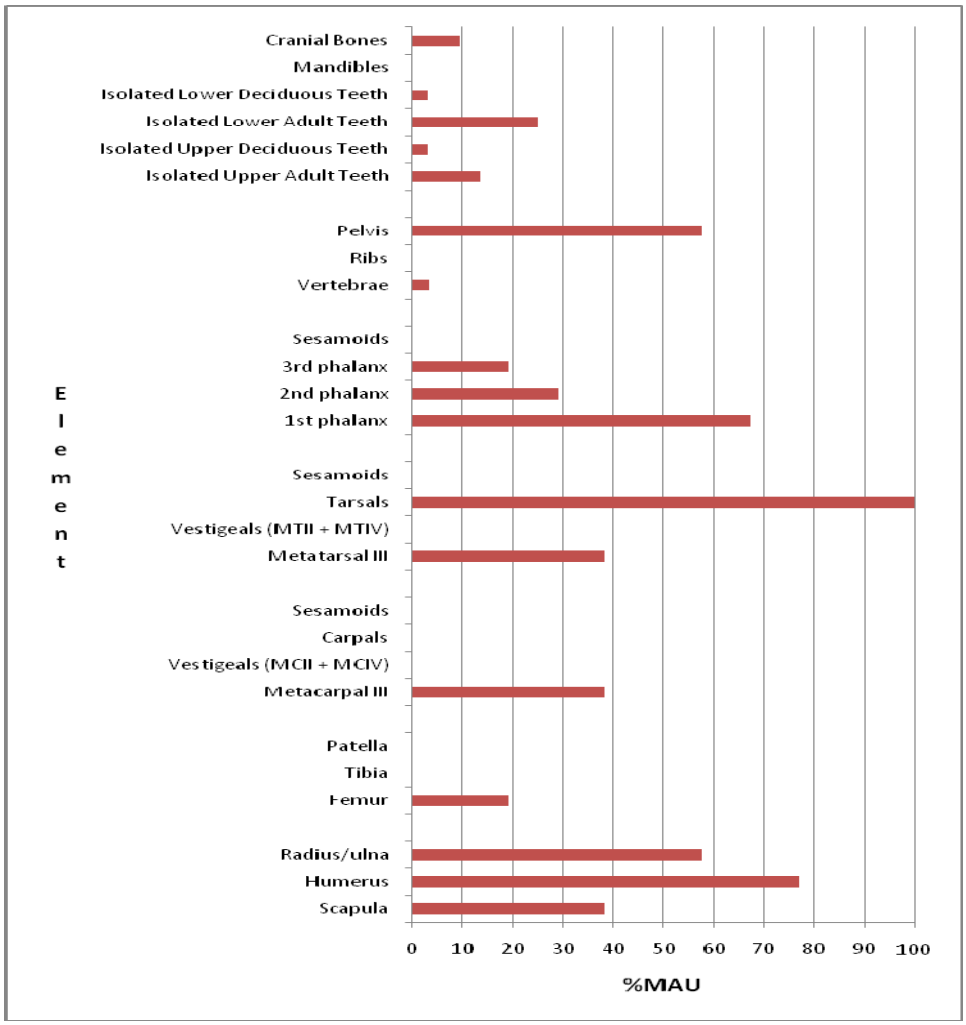


Figure 4.6.3a- Element representation among *Equus hydruntinus* remains in Level II/5.

The *Equus hydruntinus* remains in Level II/5 are dominated by the front limbs and extremities. Elements of the axial skeleton are under-represented with the exception of the pelvis.

4.6.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	1	1	Calcaneus	Corpus calcanei	*Equus hydruntinus*
Burned	0	0			
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	1	1	Humerus	DPd	*Equus hydruntinus*
Total Samples	**121**	**100**			

Table 4.6.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/5.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	0			
Polish	0	0			
Spiral Fracturing	10	8			
			Humerus	DPd,DM	*Equus hydruntinus*
			Radius	DM	*Equus hydruntinus*
			Humerus	DDd	*Equus hydruntinus*
			Humerus	DPd, DM, DDp	*Equus hydruntinus*
			Humerus	DDd	*Equus hydruntinus*
			1st Phalanx	DM	*Equus hydruntinus*
			1st Phalanx	DPp	*Equus hydruntinus*
			Metacarpal	DDd	*Cervus elaphus*
			Humerus	DPp,DPd,DM	*Equus hydruntinus*
			Femur	DDd	*Equus hydruntinus*
Total Samples	**121**	**100**			

Table 4.6.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/5.

Evidence of human activity in Level II/5 comes in the form of cut marks and one spiral fractured bone with a flake scar.

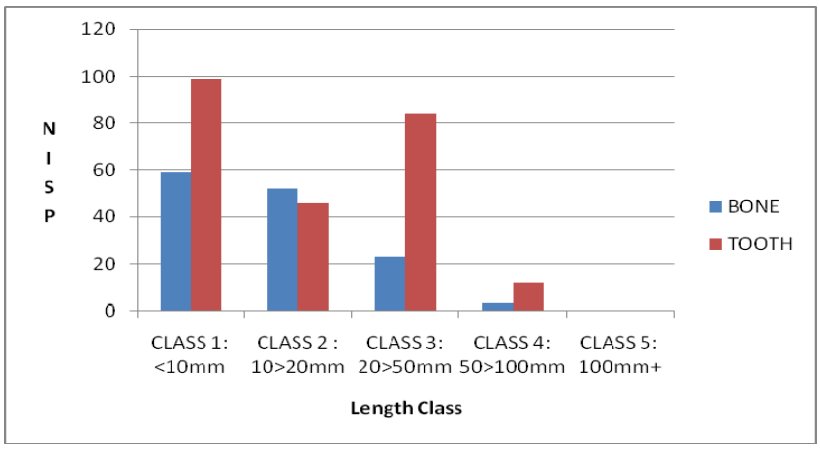


Figure 4.6.4- Relative proportions of length classes for the unidentified fragments in Level II/5.

		Cases Observed	% Cases Observed
Root Etching	P-	**5**	**4**
	P	**1**	**1**
	P+	**0**	**0**
	Sub Total	**6**	**4**
Abrasion		**0**	**0**
Weathering Stage	1	**0**	**0**
	2	**5**	**4**
	3	**55**	**41**
	4	**0**	**0**
	5	**0**	**0**
	Sub Total	**60**	**45**
Dissolution	P-	**46**	**34**
	P	**16**	**12**
	P+	**2**	**1**
	Sub Total	**64**	**47**
Manganese Oxide Staining		**5**	**4**
Total # of Occurrences		**135**	**100**

Table 4.6.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/5.

The surfaces of the faunal remains in Level II/5 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.6.5- Element Representation and the Treatment of *Equus hydruntinus*

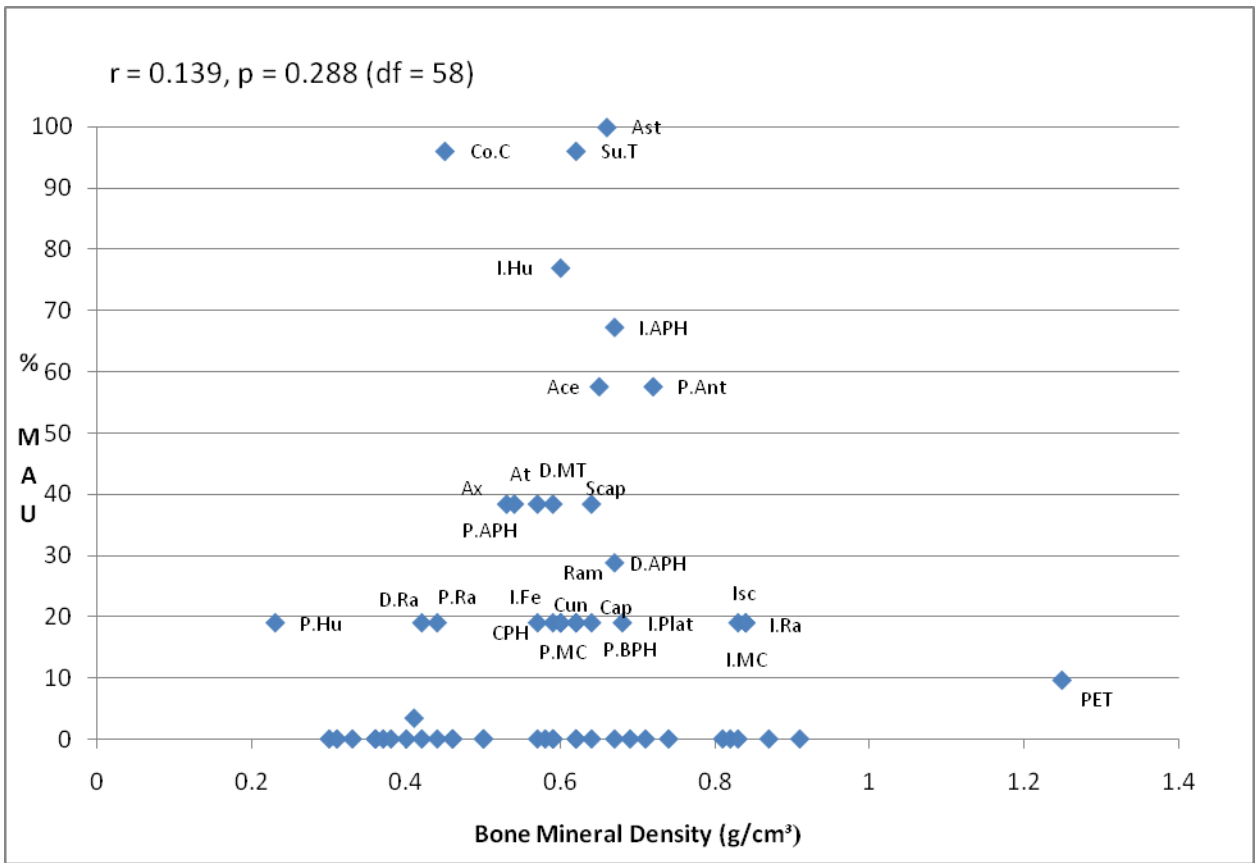


Figure 4.6.5a- Relation between mineral density and element representation for the remains of *Equus hydruntinus* in Level II/5.

The relation between mineral density and element representation is not significant.

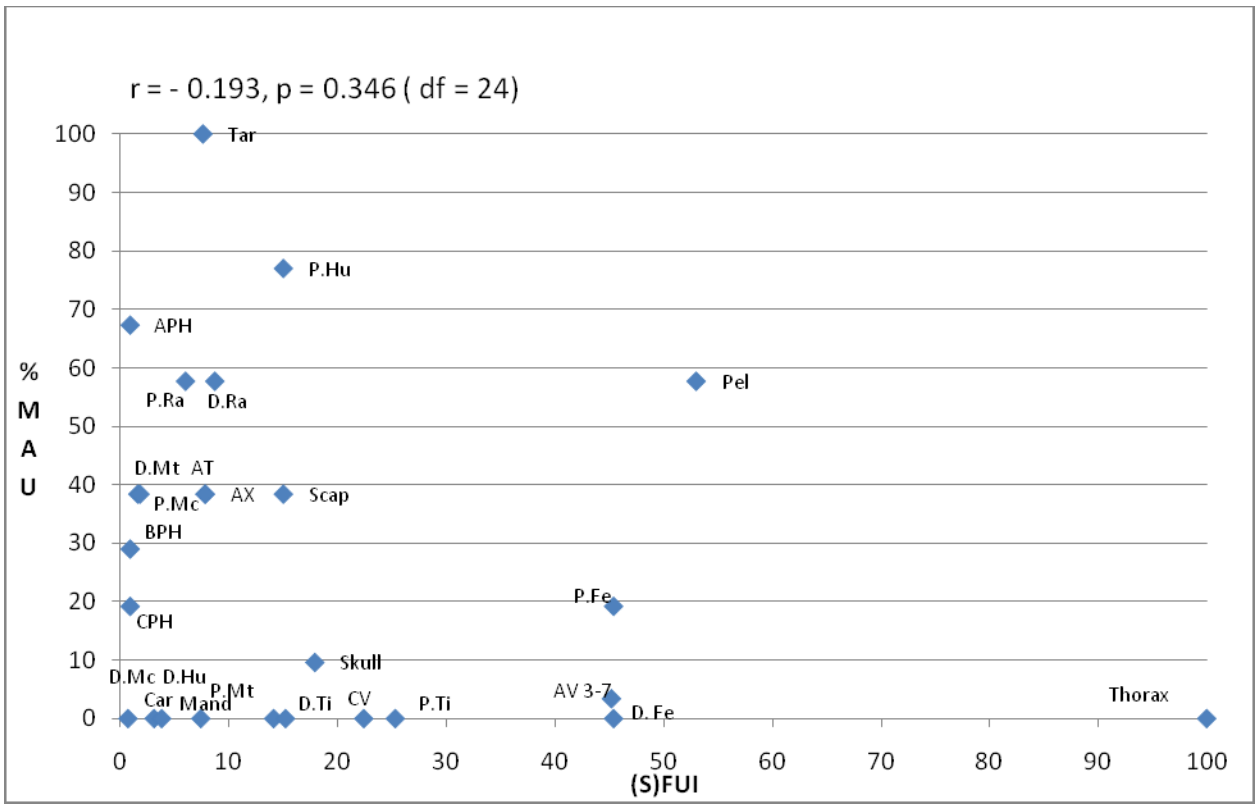


Figure 4.6.5b-Relation between element representation and their associated food values (SFUI) for the remains of *Equus hydruntinus* in Level II/5.

The relation between element representation and associated food value (SFUI) is not significant.

4.7-Level II/7

4.7.1.-Sample Size

	Number of samples	% Total Sample
Unidentified Fragments	105	52
NISP Remains Identified to the Level of Species	95	46
NISP Remains Identified to the Level of Class	4	2
Total	204	100
Proportion of Identified Remains	48%	

Table 4.7.1a- Relative bone counts for mammal remains in Level II/7.

The unidentified portion of the assemblage from Level II/7 consists of 105 unidentified samples, 44 of which are bone fragments and 61 are tooth fragments of varying size classes.

4.7.2-Species Representation

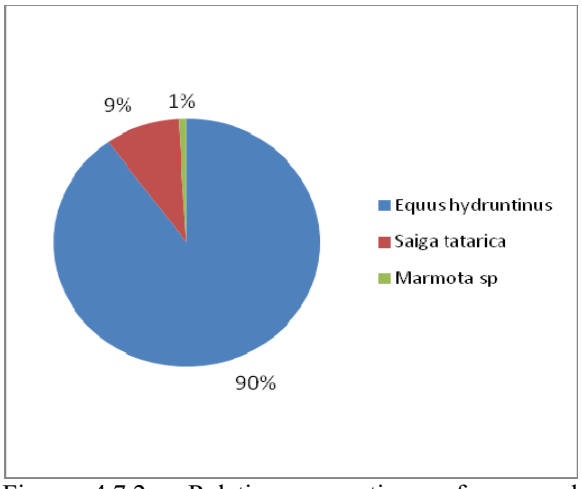


Figure 4.7.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/7.

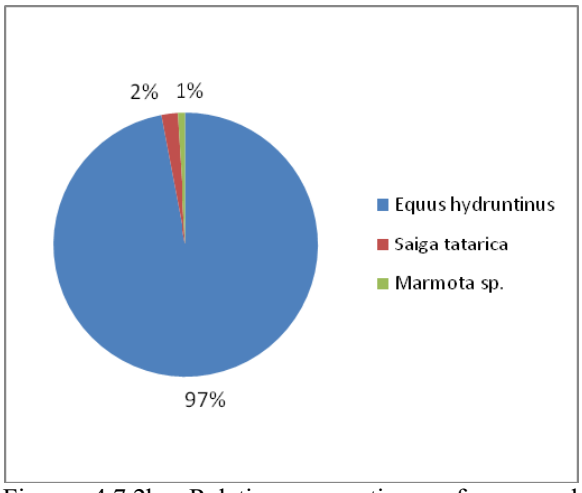


Figure 4.7.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/7.

MNI for *Equus hydruntinus* in Level II/7 is 4 individuals-1 juvenile of unknown age and 3 adults. Consequently, the season of occupation for Level II/7 cannot be determined.

MNI for saïga antelope (*Saiga tatarica)* and marmot (*Marmota sp.* cf. *bobac*) in Level II/7 is one.

4.7.3- Element Representation for the Remains of *Equus hydruntinus*

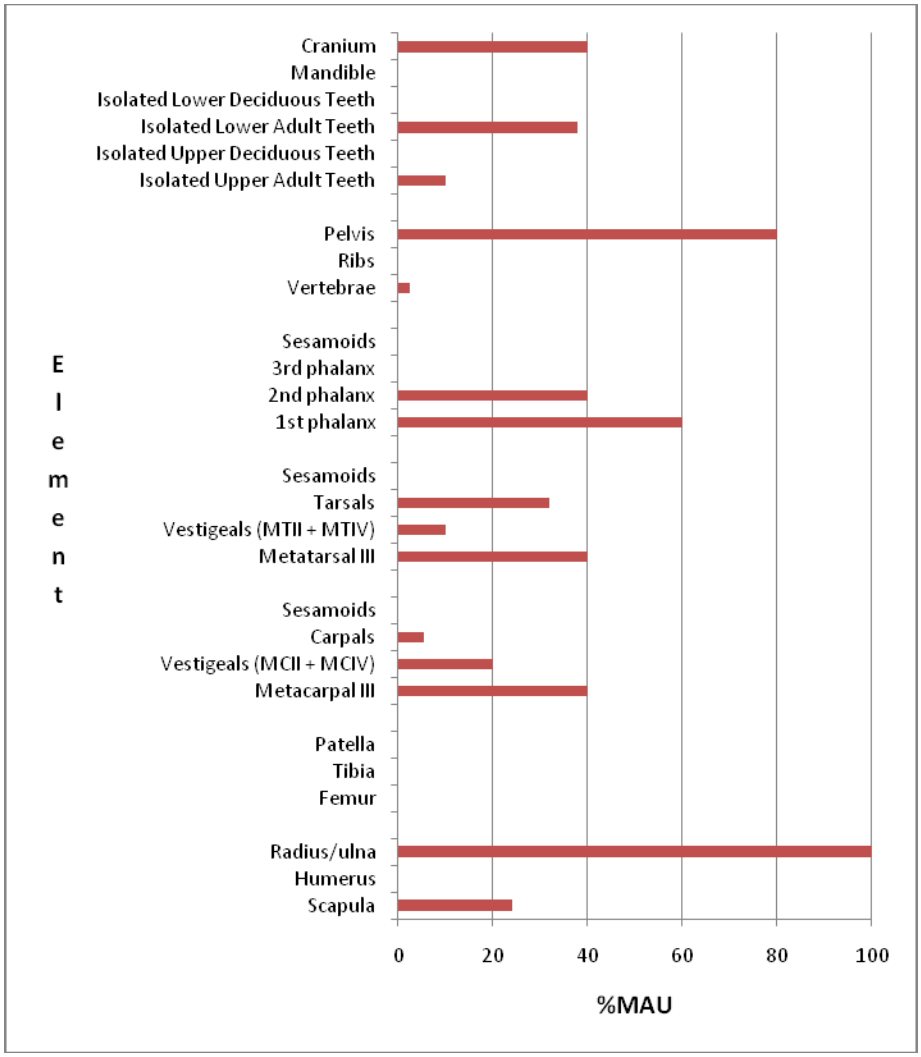


Figure 4.7.3a-Element representation among *Equus hydruntinus* remains in Level II/7.

The remains of *Equus hydruntinus* in Level II/7 are dominated by the front limbs, pelvis, and extremities. Elements of the axial skeleton are largely absent with the exception of the pelvis and cranial elements are well represented relative to other levels.

4.7.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	0	0			
Burned	0	0			
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	0	0			
Total Samples	**99**	**100**			

Table 4.7.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/7.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	0			
Polish	0	0			
Spiral Fracturing	2	2			
			1st Phalanx	ED	*Equus hydruntinus*
			Metacarpal	EP,DPp,DPd	*Equus hydruntinus*
Total Samples	**99**	**100**			

Table 4.7.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/7.

Evidence of surface modifications generated by carnivores is absent in Level II/7. Equally lacking are traces of human activity.

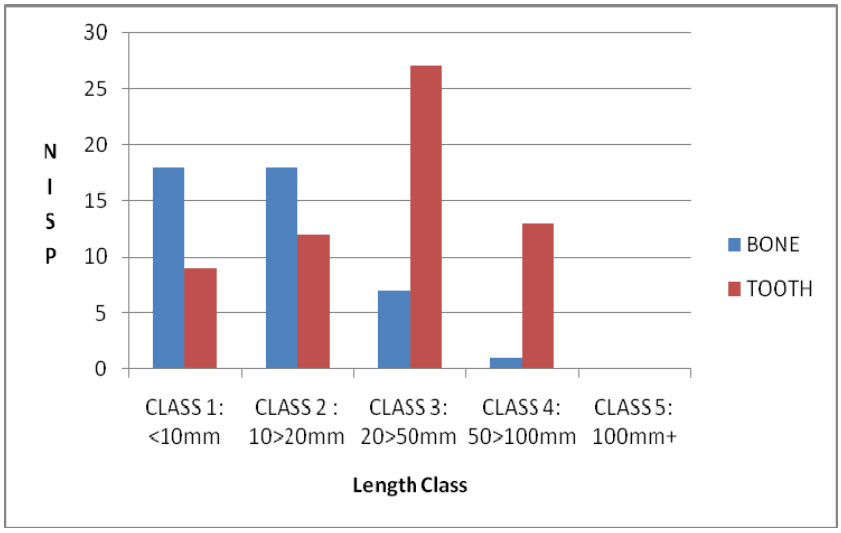


Figure 4.7.4- Relative proportions of length classes for the unidentified fragments in Level II/7.

		Cases Observed	% Cases Observed
Root Etching	P-	**11**	**7**
	P	**4**	**3**
	P+	**2**	**1**
	Sub Total	**17**	**11**
Abrasion		**1**	**1**
Weathering Stage	1	**2**	**1**
	2	**2**	**1**
	3	**41**	**29**
	4	**5**	**3**
	5	**0**	**0**
	Sub Total	**50**	**34**
Dissolution	P-	**33**	**22**
	P	**16**	**11**
	P+	**4**	**2**
	Sub Total	**53**	**35**
Manganese Oxide Staining		**28**	**19**
Total # of Occurrences		**149**	

Table 4.7.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/7.

In general, the surfaces of the faunal remains in Level II/7 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.7.5- Element Representation and the Treatment of *Equus hydruntinus*

Assessments of density mediated destruction and butchery activities could not be undertaken for Level II/7 due to small sample size.

4.8-Level II/8

4.8.1-Sample Size

	Number of samples	% Total Sample
Unidentified Fragments	644	53
NISP Remains Identified to the Level of Species	522	44
NISP Remains Identified to the Level of Class	41	3
Total	1207	100
Proportion of Identified Remains	47%	

Table 4.8.1a- Relative bone counts for mammal remains in Level II/8

The unidentified portion of the assemblage from Level II/8 consists of 644 unidentified samples, 429 of which are bone fragments and 215 are tooth fragments of varying size classes.

4.8.2-Species Representation

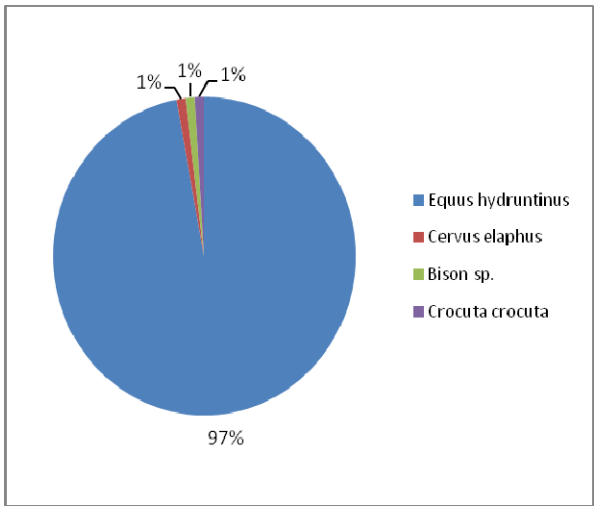


Figure 4.8.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/8.

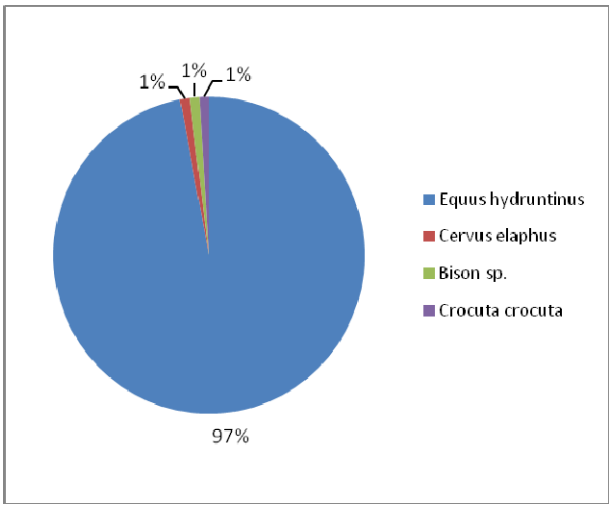


Figure 4.8.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/8.

MNI for *Equus hydruntinus* in Level II/8 is 10 individuals; 1 yearling-on the basis of an unfused calcaneus, and 2 juveniles; 1 aged 25-30 months and 1 aged 32-34 months. The remainder consists of 7 adults; 1 aged 4.5-5 years and 1 aged 3-4.5 years. The presence of the juvenile aged 25-30 months places the occupation of Level II/8 to between the mid summer and early winter. However, the presence of the adult aged 4.5-5 years and the juvenile aged 32-34 months suggests that Level II/8 was also occupied in late winter.

MNI for red deer (*Cervus elaphus),* bison (cf. *priscus*), and hyena (*Crocuta crocuta)* in Level II/8 is one.

4.8.3- Element Representation for the Remains of *Equus hydruntinus*

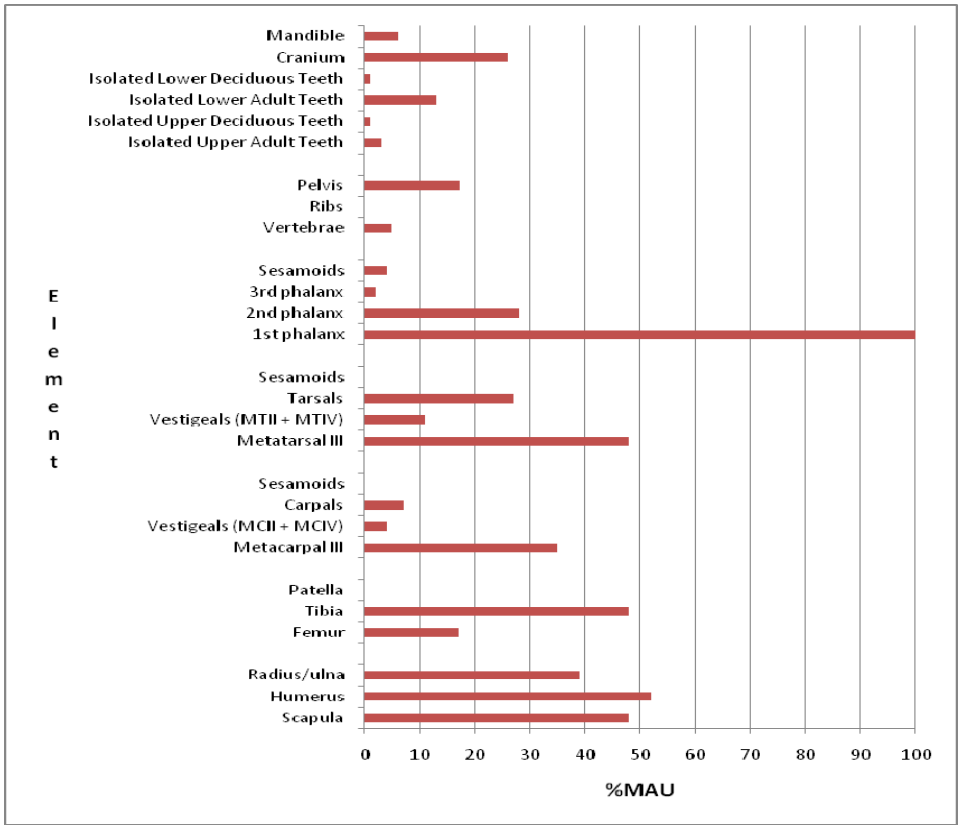


Figure 4.8.3a- Element representation among *Equus hydruntinus* remains in Level II/8.

The *Equus hydruntinus* remains in Level II/8 are dominated by extremities and front limbs. Hind limbs are also well represented. The pelvis is found in lower abundance when compared with other levels.

4.8.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	3	1			
			Humerus	DPp	*Equus hydruntinus*
			Radius	EP	*Equus hydruntinus*
			Metacarpal	EP	*Equus hydruntinus*
Burned	0	0			
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	0	0			
Total Samples	**563**	**100**			

Table 4.8.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/8

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	0			
Polish	0	0			
Spiral Fracturing	15	3			
			Humerus	DPp,DPd,DM	*Equus hydruntinus*
			Humerus	DM,DDp,DDd	*Equus hydruntinus*
			Humerus	DDp,DPd,DM	*Equus hydruntinus*
			Humerus	DM,DDp	*Equus hydruntinus*
			Humerus	DPp	*Equus hydruntinus*
			Humerus	DDp	*Equus hydruntinus*
			Radius	DPd,DM	*Equus hydruntinus*
			Radius	DDp,DDd	*Equus hydruntinus*
			Femur	DDp,DDd	*Equus hydruntinus*
			Femur	DDp,DDd	*Equus hydruntinus*
			Tibia	DPp,DPd,DM	*Equus hydruntinus*
			Tibia	DPd,DM,DDp,DDd	*Equus hydruntinus*
			Tibia	DPp,DPd	*Equus hydruntinus*
			Tibia	DPd,DM	*Bos sp.*
			Metatarsal	DM,DDp	*Bos sp.*
Total Samples	**563**	**100**			

Table 4.8.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/8.

Evidence of human activity in Level II/8 comes in the form of cut marks.

The Effects of Plants, Climate, and Diagenesis

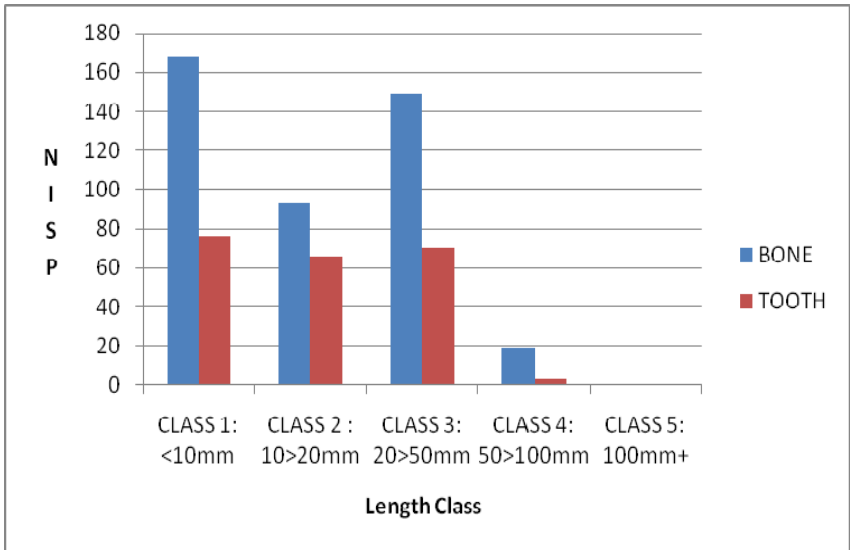


Figure 4.8.4- Relative proportions of length classes for the unidentified fragments in Level II/8.

		Cases Observed	% Cases Observed
Root Etching	P-	**66**	**6**
	P	**8**	**1**
	P+	**0**	**0**
	Sub Total	**74**	**7**
Abrasion		**10**	**1**
Weathering Stage	1	**0**	**0**
	2	**14**	**1**
	3	**375**	**35**
	4	**1**	**1**
	5	**0**	**0**
	Sub Total	**390**	**37**
Dissolution	P-	**349**	**33**
	P	**21**	**1**
	P+	**4**	**1**
	Sub Total	**374**	**35**
Manganese Oxide Staining		**207**	**20**
Total # of Occurrences		**1055**	

Table 4.8.4c- Observed frequencies of surface modifications generated by plants, climate, and diagenesis on identified remains in Level II/8.

The surfaces of the faunal remains in Level II/8 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.8.5- Element Representation and the Treatment of *Equus hydruntinus*

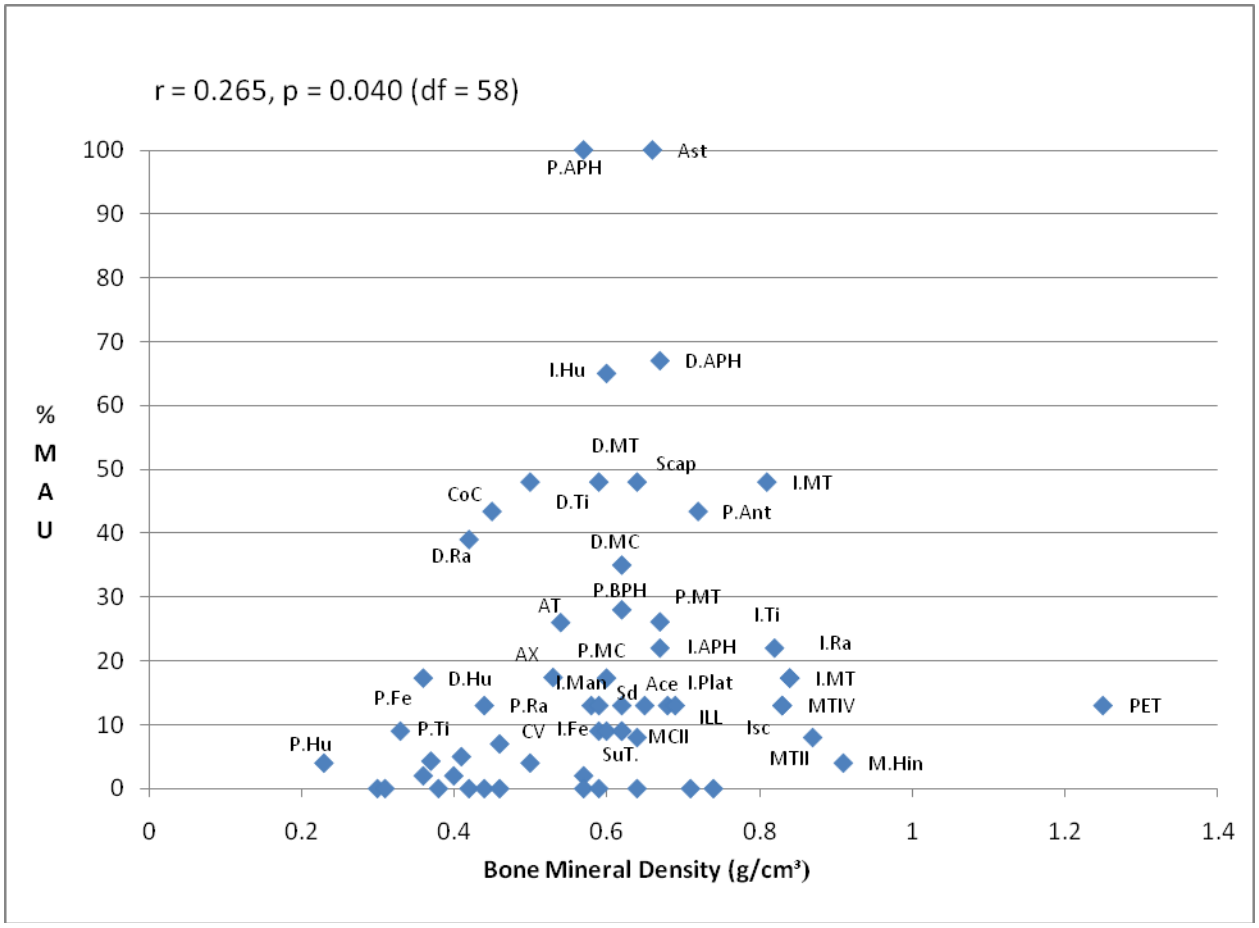


Figure 4.8.5a- Relation between mineral density and element representation for the remains of *Equus hydruntinus* in Level II/8.

The relation between mineral density and element representation is not significant.

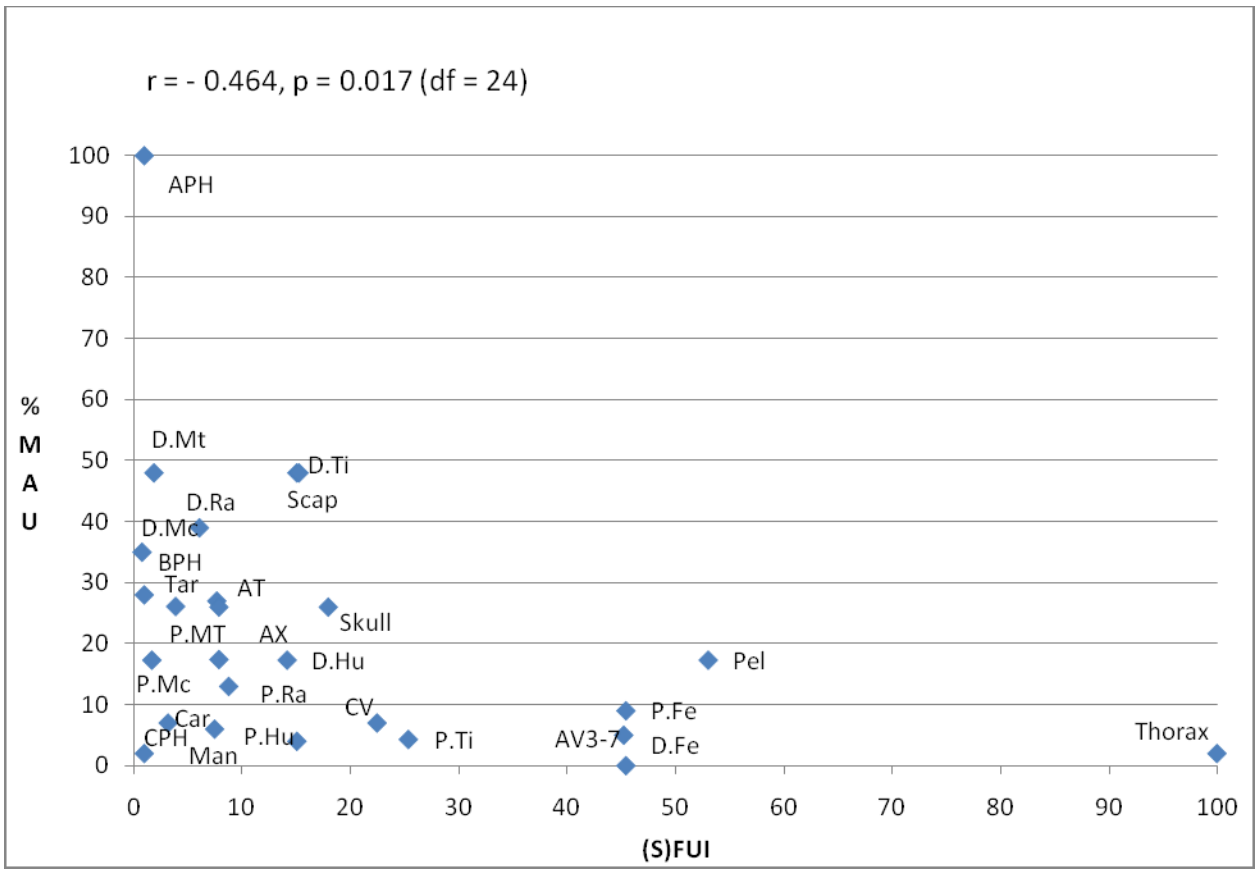


Figure 4.8.5b- Relation between element representation and their associated food values (SFUI) for the remains of *Equus hydruntinus* in Level II/8.

There is a significant negative relation between element representation and associated food values (SFUI) indicating that some elements with a high SFUI values such as femora and proximal tibiae were carried off site to a different location.

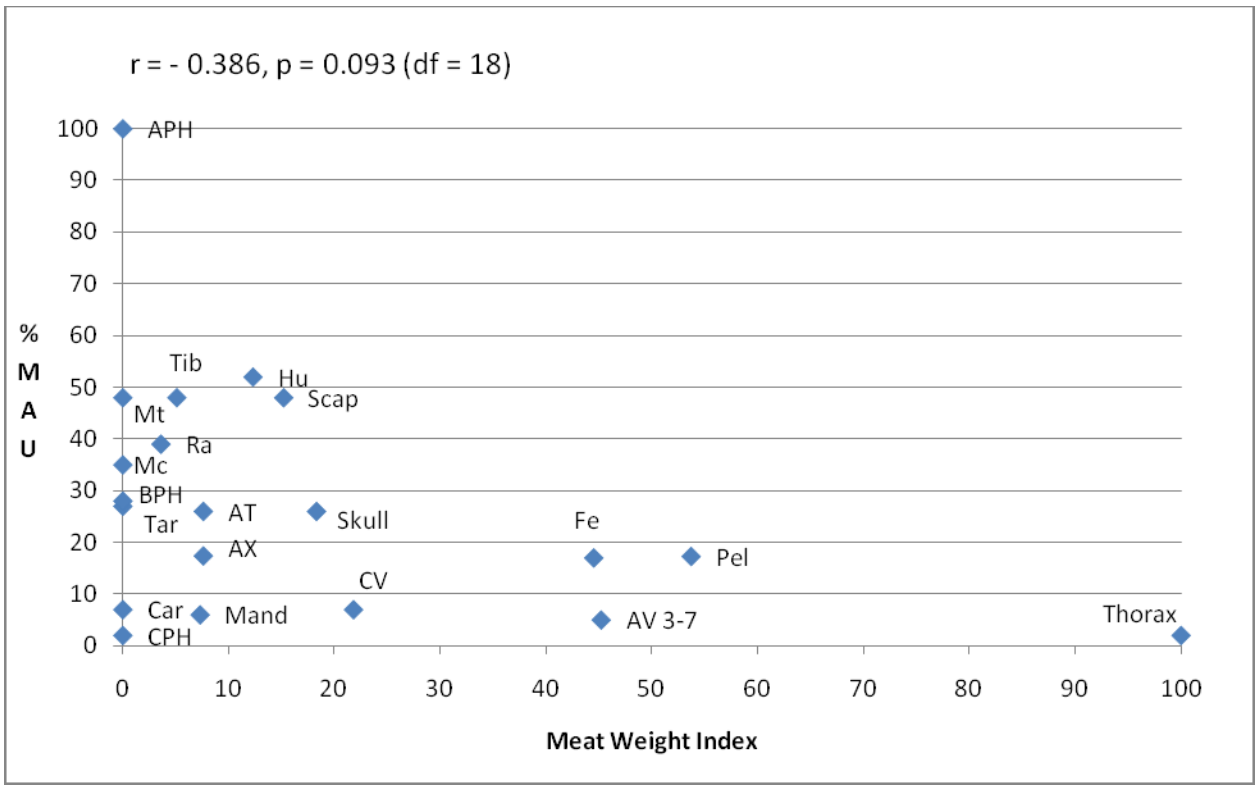


Figure 4.8.5c- Relation between element abundance and associated meat weight index for the remains of *Equus hydruntinus* in Level II/8.

The relation between element representation and meat weight index is not significant.

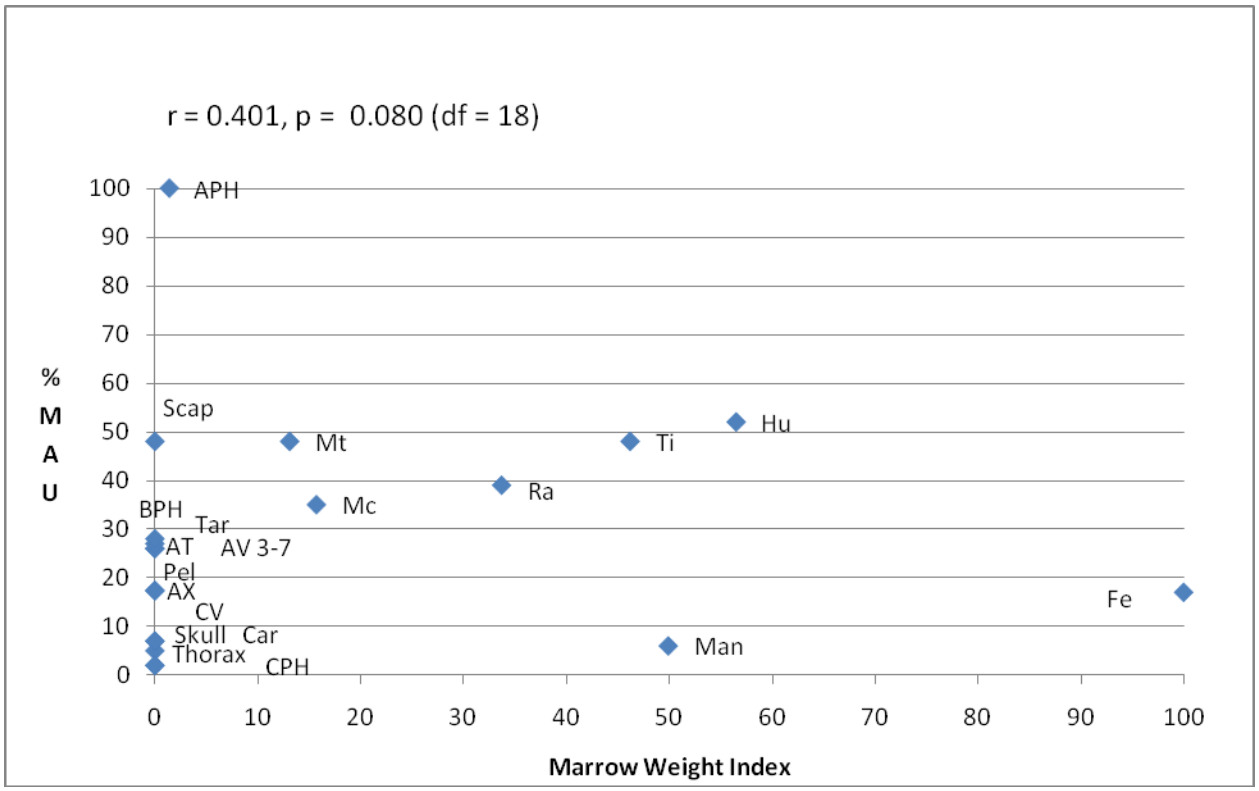


Figure 4.8.5d- Relation between element abundance and associated marrow weight index for the remains of *Equus hydruntinus* in Level II/8.

The relation between element representation and marrow weight index is not significant.

4.9-Level II/9

4.9.1-Sample Size

	Number of samples	% of Total
Unidentified Fragments	194	79
NISP Remains Identified to the Level of Species	53	21
NISP Remains Identified to the Level of Class	0	0
Total	247	100
Proportion of Identified Remains	21%	

Table 4.9.1a- Relative bone counts for mammal remains in Level II/9.

The unidentified portion of the assemblage from Level II/9 consists of 194 unidentified samples, 150 of which are bone fragments and 44 are tooth fragments of varying size classes.

4.9.2-Species Representation

Equus hydruntinus is the only species identified in Level II/9 with an MNI of 4 individuals; 2 adults (1 senile) and 2 juveniles, both aged 25-30 months. On the basis of the juveniles aged 25-30 months, the occupation of level II/9 occurred between the mid-summer and early winter.

4.9.3- Element Representation for the Remains of *Equus hydruntinus*

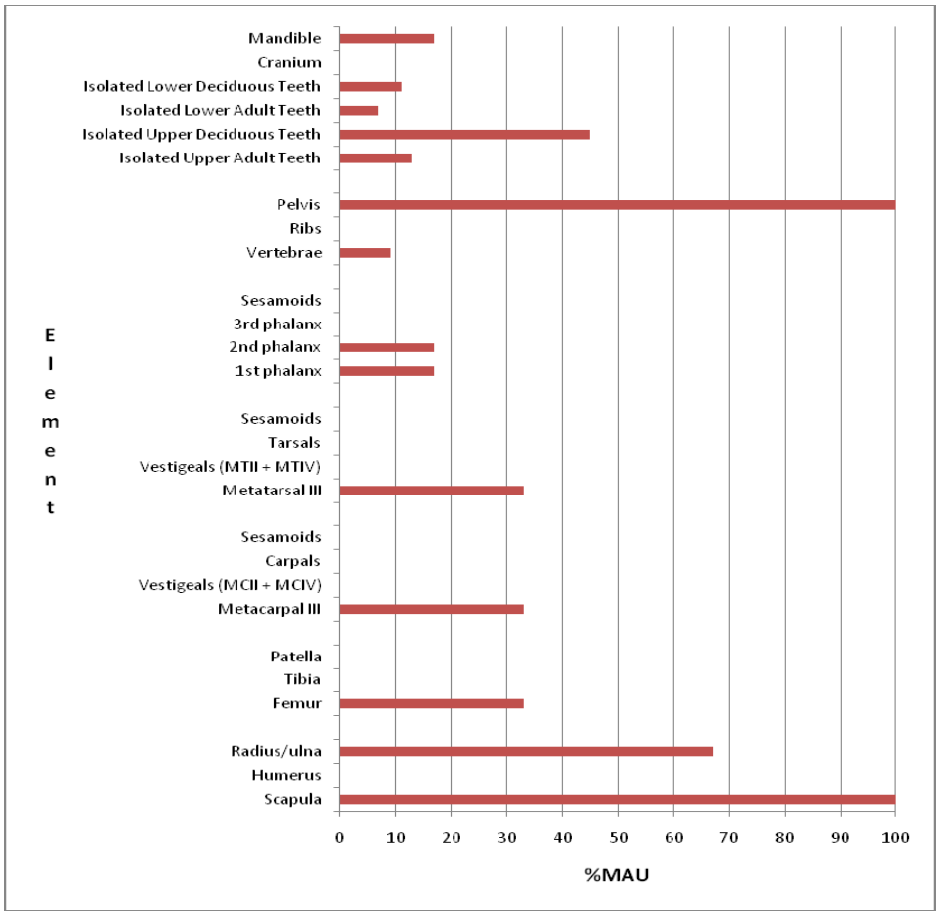


Figure 4.9.3a- Element representation among *Equus hydruntinus* remains in Level II/9.

The *Equus hydruntinus* remains in Level II/9 are dominated by the front limbs and pelvis. Other elements of the axial skeleton are mostly lacking.

4.9.4.-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Elements	Location	Species
Cut	1	2	Pelvis	Illium	*Equus hydruntinus*
Burned	0	0			
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	0	0			
Total Samples	**53**	**100**			

Table 4.9.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/9.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	1	2			
Polish	0	0			
Spiral Fracturing	2	4			
			Metapodial	DDd,ED	*Equus hydruntinus*
			Humers	DDd	*Equus hydruntinus*
Total Samples	**53**	**100**			

Table 4.9.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/9.

Evidence of human activity in Level II/9 comes in the form of cut marks.

Fragmentation

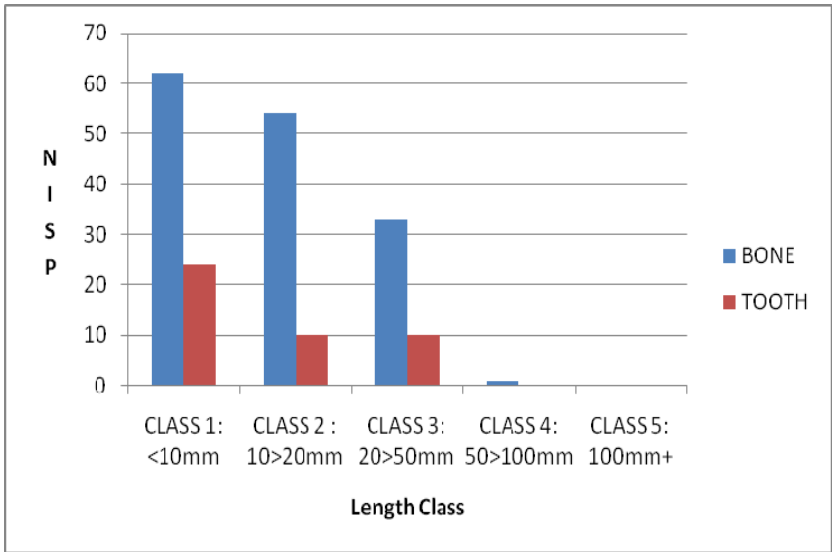


Figure 4.9.4- Relative proportions of length classes for the unidentified fragments in Level II/9.

		Cases Observed	% Cases Observed
Root Etching	P-	**8**	**7**
	P	**1**	**1**
	P+	**0**	**0**
	Sub Total	**9**	**8**
Abrasion		**0**	**0**
Weathering Stage	1	**0**	**0**
	2	**1**	**1**
	3	**33**	**31**
	4	**1**	**1**
	5	**0**	**0**
	Sub Total	**35**	**33**
Dissolution	P-	**8**	**7**
	P	**11**	**10**
	P+	**7**	**6**
	Sub Total	**26**	**24**
Manganese Oxide Staining		**37**	**34**
Total # of Occurrences		**107**	

Table 4.9.4c- Observed frequencies of surface modification generated by plants, climate, and diagenesis on identified remains in Level II/9.

The surfaces of the faunal remains in Level II/9 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.9.5- Element Representation and the Treatment of *Equus hydruntinus*

Unfortunately, assessments of density mediated destruction and butchery activities could not be undertaken for Level II/9 due to small sample size.

4.10-Level II/13

4.10.1-Sample Size

	Number of samples	**% Total Sample**
Unidentified Fragments	146	50
NISP Remains Identified to the Level of Species	144	49
NISP Remains Identified to the Level of Class	5	1
Total	**295**	100
Proportion of Identified Remains	**50%**	

Table 4.10.1a- Relative bone counts for mammal remains in Level II/13.

The unidentified portion of the assemblage from Level II/13 consists of 146 unidentified samples, 56 of which are bone fragments and 90 are tooth fragments of varying size classes.

4.10.2-Species Representation

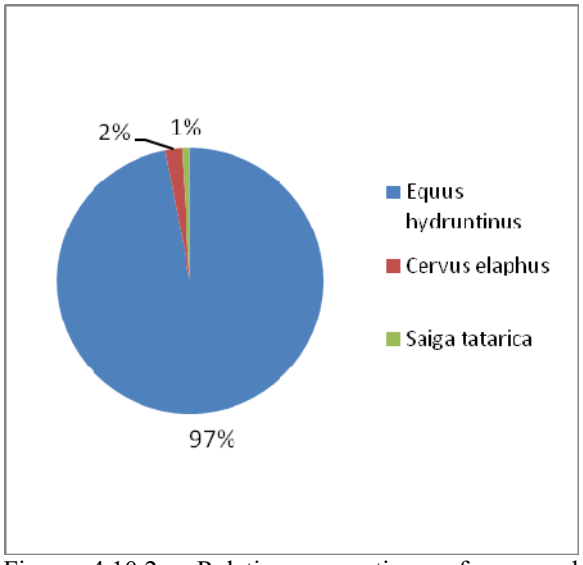


Figure 4.10.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/13.

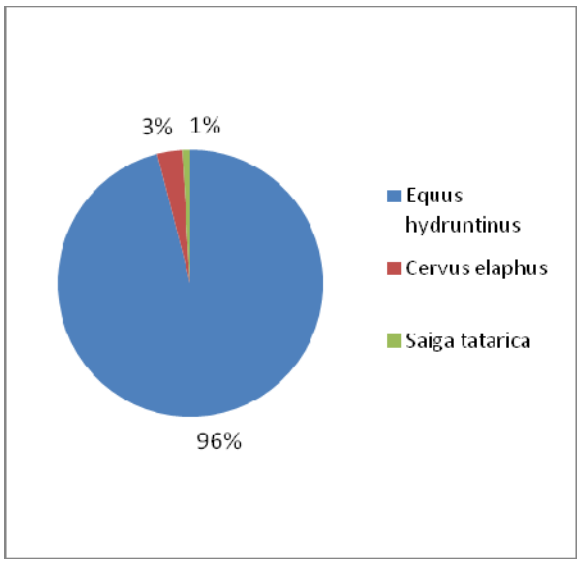


Figure 4.10.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/13.

MNI for *Equus hydruntinus* in Level II/13 is 7 individuals; 1yearling based on a completely unfused distal radius and proximal femur, 2 juveniles; 1 aged 10-15 months and 1 aged 25-30 months, and 4 adults; 1 possibly male. The presence of the 2 juveniles aged 10-15 and 25-30 months, places the occupation of Level II/13 to within the mid summer and early winter.

MNI for red deer (*Cervus elaphus)* and saiga antelope (*Saiga tatarica)* in Level II/13 is one.

4.10.3- Element Representation for the Remains of *Equus hydruntinus*

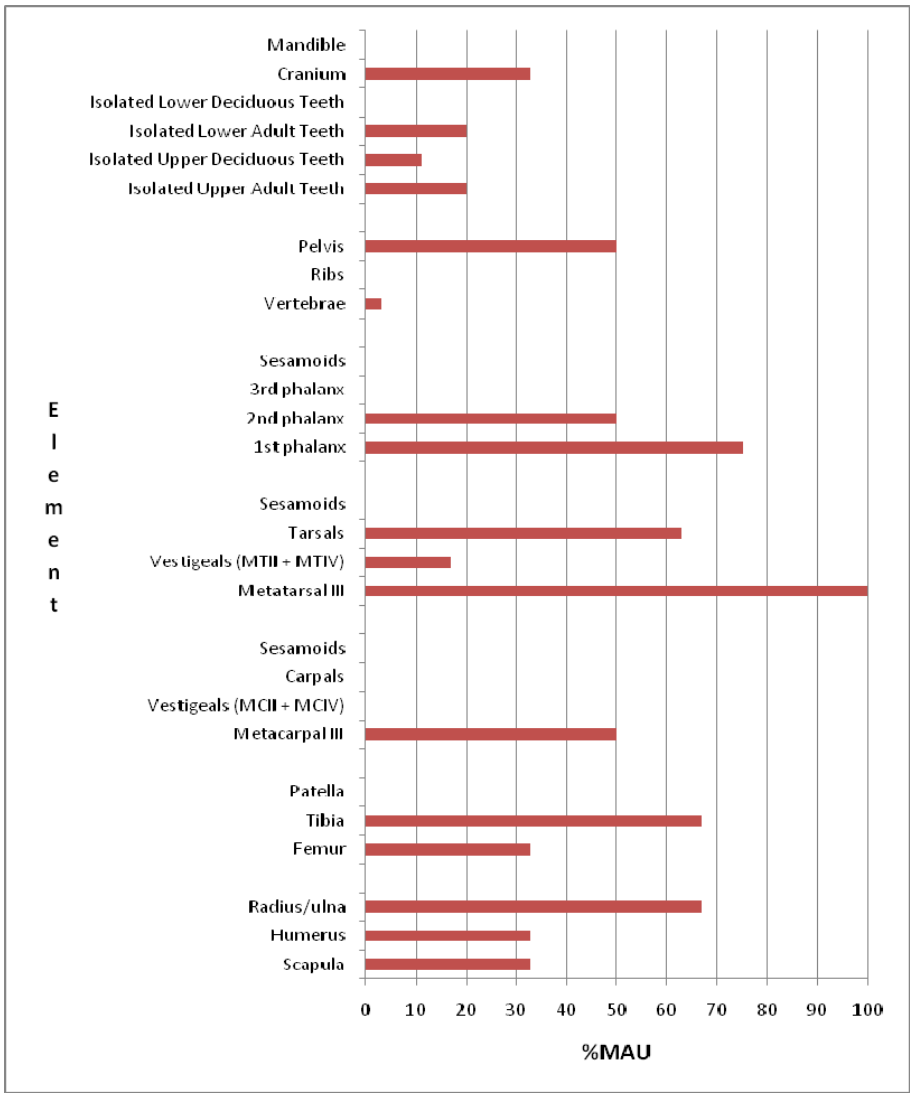


Figure 4.10.3a- Element representation among *Equus hydruntinus* remains in Level II/13.

According to Figure 4.10.3a, the *Equus hydruntinus* remains in Level II/13 are dominated by elements of the lower front and hind limbs. Elements of the extremities are also well represented as are upper front and hind limbs as well as crania. It would appear that whole animals are present in Level II/13 since nearly all elements are represented.

4.10.4-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	1	1	Tibia	ED	*Equus hydruntinus*
Burned	0	0			
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	0	0			
Total Samples	**149**	**100**			

Table 4.10.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/13.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	1	1			
Polish	0	0			
Spiral Fracturing	2	1			
			Metapodial	DDd,ED	*Equus hydruntinus*
			Humers	DDd	*Equus hydruntinus*
Total Samples	**149**	**100**			

Table 4.10.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/13.

The presence of 1 gnaw marked sample suggests that carnivores played some role in the formation of Level II/13. On the other hand, there is some direct evidence of human activity which comes in the form of cut marks and indicates that Level II/13 represents a mixed assemblage.

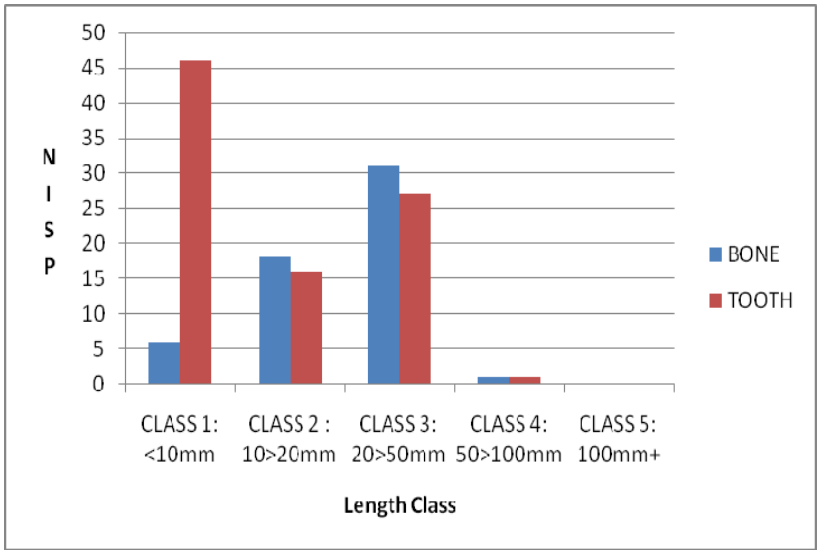


Figure 4.10.4- Relative proportions of length classes for unidentified fragments in Level II/13.

		Cases Observed	% Cases Observed
Root Etching	P-	**31**	**11**
	P	**6**	**2**
	P+	**3**	**1**
	Sub Total	**40**	**14**
Abrasion		**2**	**1**
Weathering Stage	1	**0**	**0**
	2	**7**	**2**
	3	**95**	**35**
	4	**0**	**0**
	5	**0**	**0**
	Sub Total	**102**	**37**
Dissolution	P-	**25**	**9**
	P	**7**	**2**
	P+	**2**	**1**
	Sub Total	**34**	**12**
Manganese Oxide Staining		**100**	**36**
Total # of Occurrences		**278**	

Table 4.10.4c- Observed frequencies of surface modification generated by plants, climate, and diagenesis on identified remains in Level II/13.

The surfaces of the faunal remains in Level II/13 are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.10.5- Element Representation and the Treatment of *Equus hydruntinus*

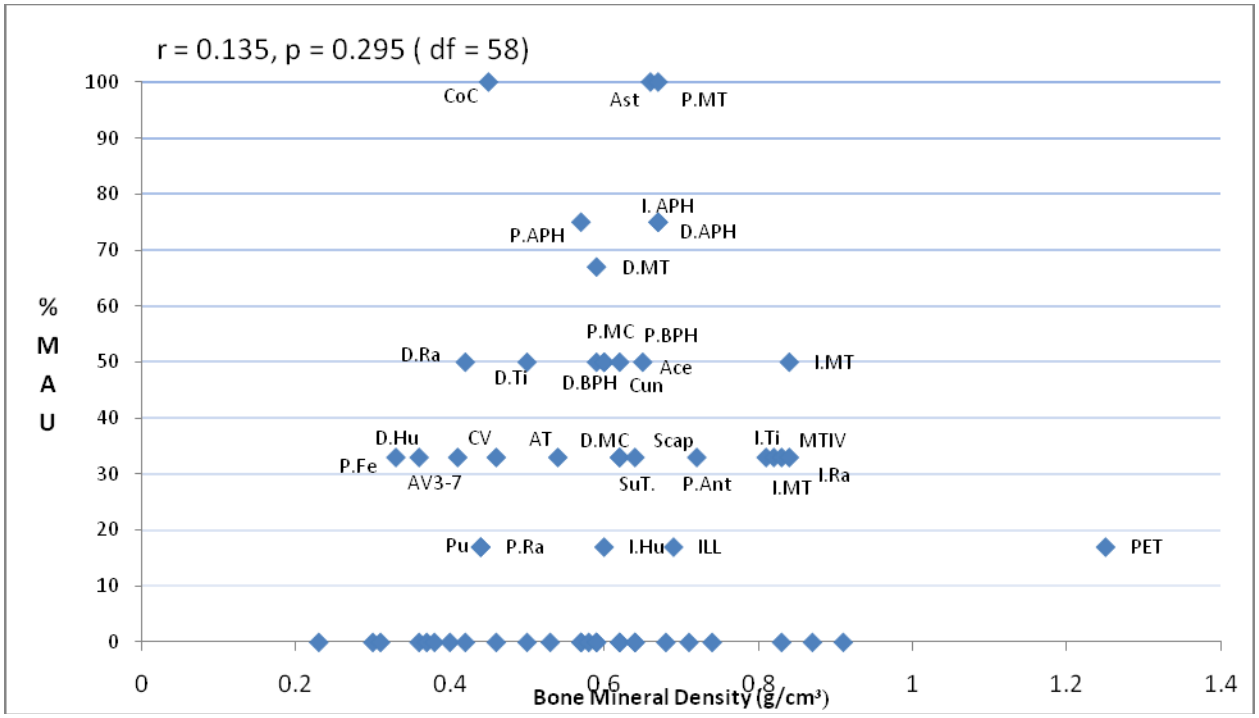


Figure 4.10.5a- Relation between mineral density and element representation for the remains of *Equus hydruntinus* in Level II/13.

The relation between mineral density and element representation is not significant.

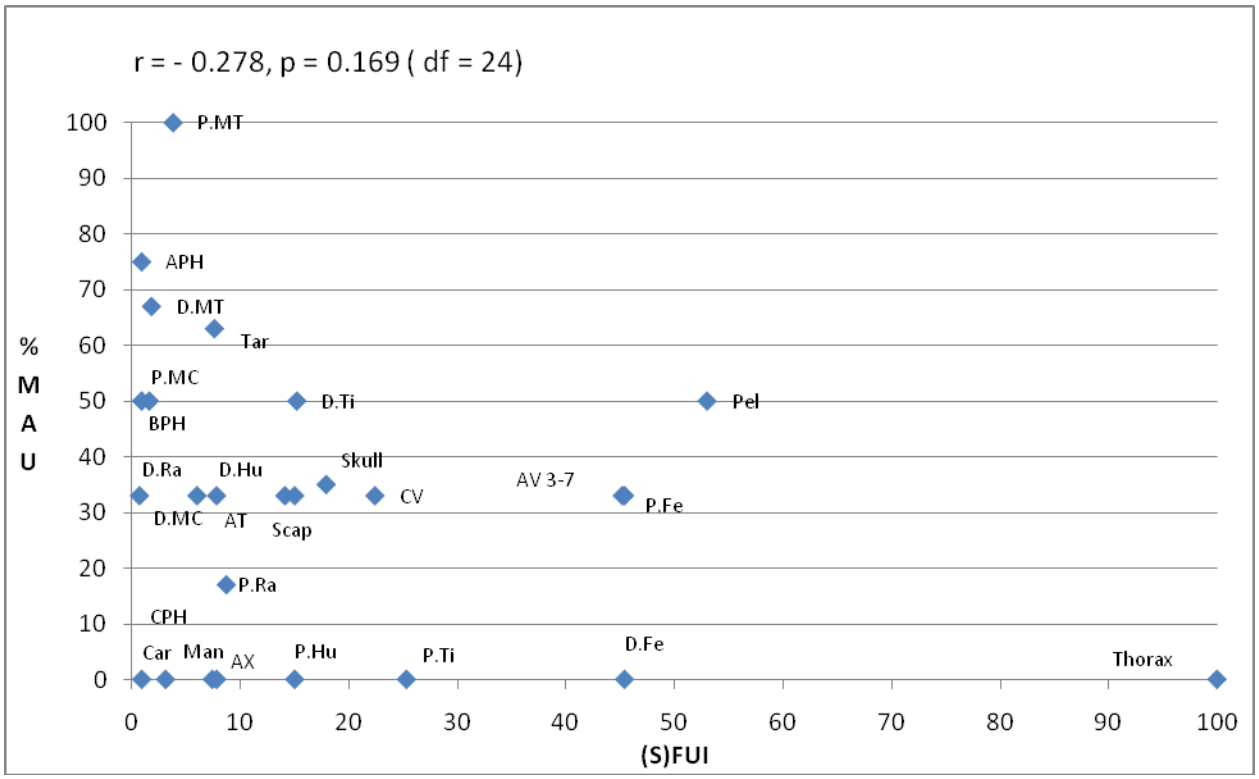


Figure 4.10.5b- Relation between element representation and their associated food values (SFUI) for the remains of *Equus hydruntinus* in Level II/13.

The relation between element representation and associated food value (SFUI) is not significant.

4.11-Level II/13A

4.11.1- Sample Size

	Number of samples	% of Total Sample
Unidentified Fragments	22	47
NISP Remains Identified to the Level of Species	25	53
NISP Remains Identified to the Level of Class	0	0
Total	47	100
Proportion of Identified Remains	53%	

Table 4.11.1a- Relative bone counts for mammal remains in Level II/13A.

The unidentified portion of the assemblage from Level II/13A consists of 22 unidentified samples, 19 of which are bone fragments and 3 are tooth fragments of varying size classes.

4.11.2-Species Representation

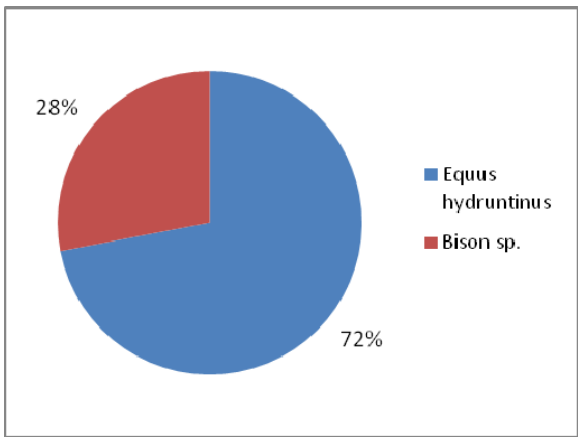


Figure 4.11.2a- Relative proportions of mammal species based on identified remains (%NISP) in Level II/13A.

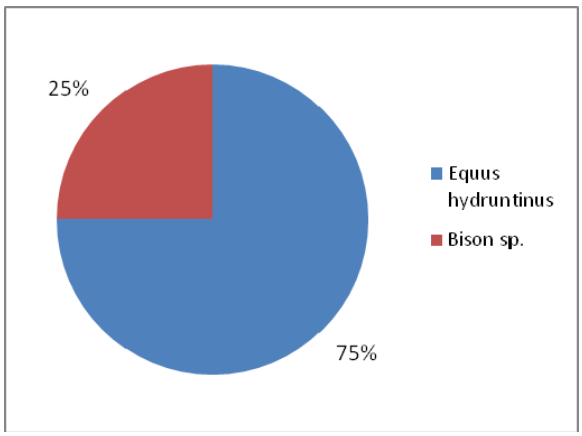


Figure 4.11.2b- Relative proportions of mammal species based on identified elements (%MNE) in Level II/13A.

MNI for *Equus hydruntinus* in Level II/13A is 2 individuals; 1 juvenile aged 25-30 months and 1 adult. The presence of the juvenile aged 25-30 months, places the occupation of Level II/13A between the mid summer and early winter.

MNI for bison (cf. *priscus*) in Level II/13A is one.

4.11.3- Element Representation for the Remains of *Equus hydruntinus*

The analysis of element representation for *Equus hydruntinus* could not be undertaken due to small sample size.

4.11.4.-Taphonomy

The Role of Carnivores vs. Humans in Assemblage Formation

	Cases Observed	% Cases Observed	Element	Location	Species
Cut	0	0			
Burned	0	0			
Flake Scars	0	0			
Flake Scars with Spiral Fracturing	0	0			
Total Samples	**25**	**100**			

Table 4.11.4a- Observed frequencies anthropic surface modifications on identified remains in Level II/13A.

	Cases Observed	% Cases Observed	Element	Location	Species
Gnawing	0	0			
Polish	0	0			
Spiral Fracturing	1	4			
			Humerus	DDp,DDd	*Equus hydruntinus*
Total Samples	**25**	**100**			

Table 4.11.4b- Observed frequencies of surface modifications generated by carnivores on identified remains in Level II/13A.

There does not appear to any direct evidence linking carnivores or humans to the formation of the assemblage from Level II/13A although this is likely a product of sample size.

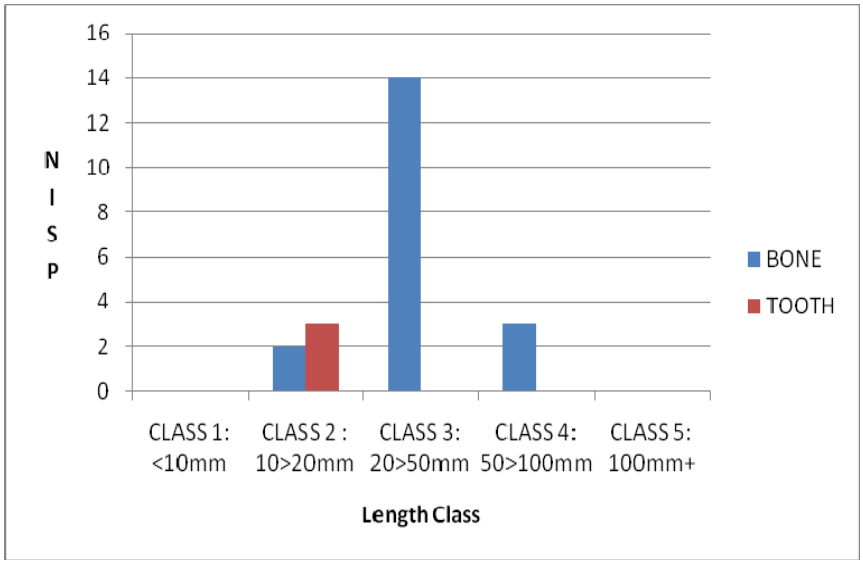


Figure 4.11.4- Relative proportions of length classes for the unidentified fragments in Level II/13A

		Cases Observed	% Cases Observed
Root Etching	P-	**13**	**26**
	P	**0**	**0**
	P+	**0**	**0**
	Sub Total	**13**	**26**
Abrasion		**1**	**2**
Weathering Stage	1	**0**	**0**
	2	**0**	**0**
	3	**13**	**26**
	4	**1**	**2**
	5	**0**	**0**
	Sub Total	**14**	**28**
Dissolution	P-	**4**	**8**
	P	**1**	**2**
	P+	**0**	**0**
	Sub Total	**5**	**10**
Manganese Oxide Staining		**17**	**34**
Total # of Occurrences		**50**	

Table 4.11.4c- Observed frequencies of surface modification generated by plants, climate, and diagenesis on identified remains in Level II/13A.

The surfaces of the faunal remains in Level II/13A are poorly preserved as demonstrated by the high degree of weathering and dissolution.

4.11.5- Element Representation and the Treatment of *Equus hydruntinus*

Assessments of density mediated destruction and butchery activities could not be undertaken for Level II/13A due to the small sample size.

4.12- Summary of Results

	Level II/1	**Level II/2**	**Level II/3**	**Level II/5**	**Level II/8**	**Level II/13**
Proportion of Identified Remains	31%	49%	40%	24%	47%	50%
MNI *Equus hydruntinus*	8	11	7	13	10	7
MNI Other Species:						
Cervus elaphus	1	0	1	1	1	1
Saiga tatarica	0	0	0	1	0	1
Sus scrofa	0	0	1	0	0	0
Bison (cf. *priscus*)	0	0	0	0	1	0
Crocuta crocuta	0	0	0	0	1	0
Season of Occupation	Mid-summer/Early winter	Mid-summer/Early winter	Mid-summer/ Late winter	Mid-summer/Late winter	Mid-summer/early winter + Late winter	Mid-summer/Early winter
Dominant Elements	Hind Limbs	Pelvis, Front Limbs, Hind Limbs	Extremities	Front Limbs, Extremities	Front Limbs, Hind Limbs, Extremities	Front Limbs, Hind Limbs
Human Presence	Yes	Yes	Yes	Yes	Yes	Yes
Carnivore Presence	No	Yes	No	No	Yes	Yes
Dominant Length Class for Bone Fragments	1	3	2	1	1	3
In Situ Destruction	No	Yes	No	No	No	No
Selective Transport	No	Yes	Yes	No	Yes	No

Table 4.12.1- Summary of results for assemblages with an MNI greater than 4.

V-Discussion

The results obtained through the analysis of the faunal remains from Levels II/1, II/2-1, II/2, II/3, II/4, II/5, II/7, II/8, II/9, II/13 and II/13A concur with and compliment the results of the previously published analyses of Patou-Mathis (2006a, 2006b, 2005, 2003, 1999). Small sample sizes and poor surface preservation of the bones in these assemblages impose some limits on how far the interpretation of these results can go. For instance, small sample size potentially limits species representation in some of these assemblages. Poor surface preservation may also delete traces left by humans and animals making it difficult to assess their role in assemblage formation, therefore.

In spite of these shortcomings however, the new data from Kabazi II does contribute to our understanding of site function, local settlement patterns, and the subsistence activities of Crimean Neanderthals over time. In order to demonstrate this, the results for species diversity, seasonality, anatomic representation, taphonomy, element representation, and the treatment of *Equus hydruntinus* are presented here. In addition, the relation between Kabazi II and the nearby rock-shelter of Kabazi V will be assessed and finally, the ethology of the animal species represented in these assemblages will be used to add to a discussion of patterns of land use and game acquisition strategies at Kabazi II.

5.1-Comparisons of Species Diversity

Equus hydruntinus is the best represented species at Kabazi II constituting over 90% of the identifed elements in all assemblages. The only exception is Level II/13A where the remains of *Equus hydruntinus* comprise 75% of identified elements and the remains of bison (cf. *priscus*) comprise 25% of identified elements in this assemblage. This could be a product of small sample size since the total number of samples in this assemblage is N = 47.

Other identified taxa include: red deer (*Cervus elaphus*) in Levels II/1, II/3, II/5, II/8, and II/13, saiga antelope (*Saïga tatarica*) in Levels II/2-1, II/5, II/7, and II/13, bison (cf. *Bison*

priscus) in Levels II/2-1, II/8, II/13A, ibex (*Capra ibex*) in Level II/2-1, wild pig (*Sus scrofa*) in Level II/3, marmot (*Marmota* cf. *bobac*) in Level II/7, and hyena (cf. *Crocuta crocuta*) in Level II/8. These species are all represented by single individuals (MNI = 1) in any given level (See Chapter IV).

The likely explanation for this trend is that while the occupants Kabazi II were primarily interested in hunting small groups of *Equus hydruntinus,* they were not entirely restricting their quarry to a single species. The remains of red deer (*Cervus elaphus*), saiga antelope (*Saïga tatarica*), ibex (*Capra ibex)*, bison (cf. *Bison priscus*), wild pig (*Sus scrofa*), and marmot (*Marmota sp.*cf. *bobac*) are represented by only a few bones each where identified. These were likely hunted opportunistically either on the valley floor, on the slopes of the cuesta, or on the steppe above the site. The hyena tooth fragment (cf. *Crocuta crocuta*) found in Level II/8 likely represents the presence of scavengers after the site was abandoned. This is also confirmed by the presence of gnaw marks in Levels II/2-1, II/2, II/9, and II/13.

The relative representation of species in the assemblages and the dominance of *Equus hydruntinus* (i.e. over 90%) is nearly identical to the results of the previous faunal analyses at Kabazi II conducted by Patou-Mathis (1999, 2005, 2006a, 2006b, 2003). The remains of megafauna (i.e. *Megaloceros giganteus* and *Coleodonta antiquitatis*), canids (*Canis lupus* and *Cuon alpinus*), fox (*Vulpes vulpes* or *Alopex lagopus*), mustelids (*Mustelidae sp.*), bear (*Ursus sp.*), horse (*Equus caballus*), cave lion (*Pantera leo spelaea*), hare (*Lepus sp.*), chamois (*Rupicapra rupicapra*), and auroch (*Bos primigenius)*, identified by Patou-Mathis in other assemblages, do not occur in any of the assemblages analyzed in this study (possibly as a result of sample size). Nevertheless, these species do not exceed 5% of identified remains (%NISP) and elements (%MNE) in each assemblage when compared to the relative proportions of *Equus hydruntinus* (Patou-Mathis 1999, 2005, 2006a, 2006b, 2003). These species represent either isolated, chance encouters or as in the case of megafauna, possible scavenging as reported by Patou-Mathis (1999, 2005, 2006a, 2006b). *Equus hydruntinus* remains the focus of faunal procurement activities at Kabazi II, therefore.

5.2-Age and Herd Structure

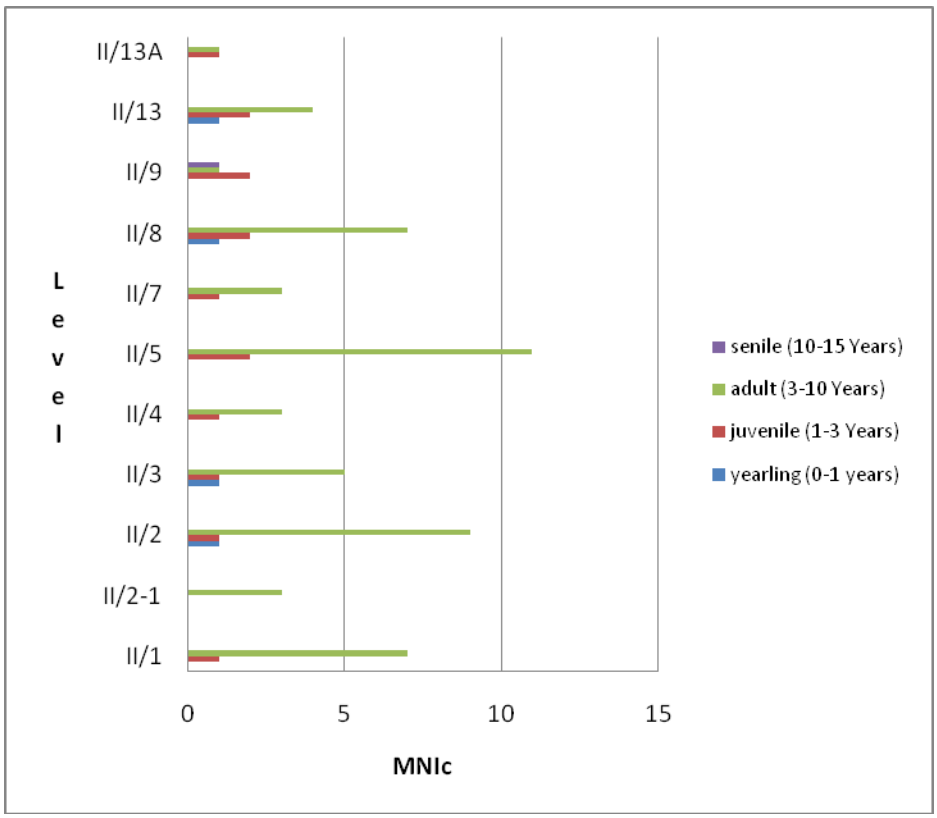


Figure 5.2.1- Age categories represented among the remains of *Equus hydruntinus* in Levels II/1, II/2-1, II/2, II/3, II/4, II/5, II/5, II/7, II/8, II/9, II/13, and II/13A.

On the basis of tooth eruption and wear as well as epiphyseal fusion, it appears that the occupants of Kabazi II were primarily targeting groups of adult *Equus hydruntinus* accompanied by foals, as seen in all assemblages with the exception of Levels II/9 and II/2-1 (Figure 5.2.1). Unfortunately, morphometric assessments of age and sex could not be undertaken since the elements in each assemblage are heavily fragmented. Nevertheless, the majority of adult remains are likely those of females since they are more likely to be accompanied by foals. It is believed that *Equus hydruntinus,* like other asiatic wild asses (*Equus hemionus*), did not form stable social groups (Burke 2006) - contrary to the social behaviour of caballoid horses, where "harems" are established (Bahloul et al 2001; Baskin & Danell 2003).

Levels II/3 and possibly II/13 may contain the remains of male *Equus hydruntinus.*This was inferred on the basis of a burgeoning canine tooth in Level II/3 and a large calcaneus which resembles *Equus hydruntinus* morphologically. In the absence of morphometric data, it would be

possible to infer that the assemblage in Level II/3 may represent a mixed male-female group. The presence of males and females can indicate either the presence of both sexes during the breeding season (See Table 5.3.1 and Chapter IV, section 4.4.2) which could have occured in late May or June (Burke 2006; Bahloul et al 2001; Baskin & Danell 2003) or during periods when animals seek shelter. Alternatively, based on the age of the canine tooth in Level II/3 (at 3-3.5 years), this male *Equus hydruntinus* may represent a foal on the verge of leaving its mother at the onset of sexual maturity (this occurs at approximately 3 years of age in Asiatic asses (Baskin & Danell 2003, 12-Table 1.6)).

Alternatively, different hunting episodes may have taken place and Level II/3 may represent a palimpsest of hunting episodes spanning several seasons. However, the possibility that the assemblage in Level II/3 represents one large female-foal group cannot be excluded entirely.

Males, females and foals have previously been identified in Levels II/7AB to II/7 E, II/8, II/8C, IIA/1 to IIA/2-3 as well as IIA/4 and IIA/4B (see Patou-Mathis 2006a,1999). Predation on male *Equus hydruntinus* was also hypothesized in Level IIA/2 based on the identification of three males (Patou-Mathis 2006a, 51). Mid summer – early winter deaths are reported in a number of assemblages such as Levels II/1, II/2, II/3, II/4, II/5, II/8, II/9, II/13, and II/13A (Table 5.3.1). The occupants of Kabazi II, therefore, could have hunted herds of *Equus hydruntinus* on their summer range or in breeding territories (the breeding season hypothetically follows shortly after foaling season in late May or June (Burke 2006)) or possibly *en route* to their winter range as suggested by Patou-Mathis (1999, 2005, 2006a, 2006b).

5.3-Comparisons of Seasonality

	Spring			Summer			Autumn			Winter		
Level	Early	Middle	Late	Early	Middle	Late	Early	Middle	Late	Early	Middle	Late
II/1					X	X	X	X	X	X		
II/2-1												
II/2					X	X	X	X	X	X		
II/3					X	X	X	X	X	X	X	X
II/4					X	X	X	X	X	X		
II/5	X				X	X	X	X	X	X	X	X
II/7												
II/8					X	X	X	X	X	X	X	X
II/9					X	X	X	X	X	X		
II/13					X	X	X	X	X	X		
II/13A					X	X	X	X	X	X		

Table 5.3.1-Summary of results for season of occupation for each level determined on the basis of eruption, wear, and loss of deciduous teeth.

According to Table 5.3.1, juvenile equids were killed during an extended period spanning mid-summer (July) to early winter (December) if May/ June birth timings are considered. By extension, the time of death indicates when the site was occupied – therefore, the majority of occupations studied here appear to have taken place between mid summer and early winter.

The analysis of teeth from Levels II/5 and II/8 suggest that these levels were also occupied over the winter months, however. In Level II/5 one occupation takes place during the mid summer to early winter (based on a juvenile aged 25-30 months) and may have included the winter and early spring (based on a juvenile aged 10-20 months). The relatively high MNI for Level II/5 (N = 13) suggests that it may represent a palimpsest. Level II/8 provides the strongest indication of a palimpsest at Kabazi II in which two distinct seasons of occupation are recognised: one between mid-summer to early winter (based on a juvenile aged 25-30 months) and the other, in late winter (based on a juvenile aged 32-34 months), potentially January to March. The winter occupation in Level II/8 was inferred on the basis of ages derived for a deciduous upper third premolar and a burgeoning adult incisor identified as *Equus hydruntinus*.

This winter occupation confirms previous analyses of an assemblage from Level II/8 conducted by Patou-Mathis (2006a, 2003) and represents one of two distinct winter occupations

at Kabazi II, the other being Level III/2 (Patou-Mathis 2006b, 237). Patou-Mathis (2006a, 58) suggests that this multiple occupation in Level II/8 may represent a period of sudden warming and increased precipitation at the onset of the Hengelo Interstadial at around 40 000 BP as indicated by the results of the palynological studies of Gerasimenko (2005, 38). As a result of this climatic amelioration, Patou-Mathis (2006a, 2003) suggests *Equus hydruntinus* may have remained in the area in large numbers all year-round, attracting predators such as Neanderthals, to the site at different times of year. Unfortunately, a similar claim for Level II/5 cannot be made since no pollen has been recovered from the sediments associated with this occupation (Gerasimenko 2005, Table 2-1).

Level II/8 is also much thicker than other levels and it does not exhibit the more common "carpet" scatter (where the thickness of the level equals the thickness of a single bone or artifact) seen in other levels. Instead, Level II/8 is 15cm thick at the center of the concentration (Chabai 2005, 12). This either indicates a longer occupation than other levels or the possibility of a palimpsest.

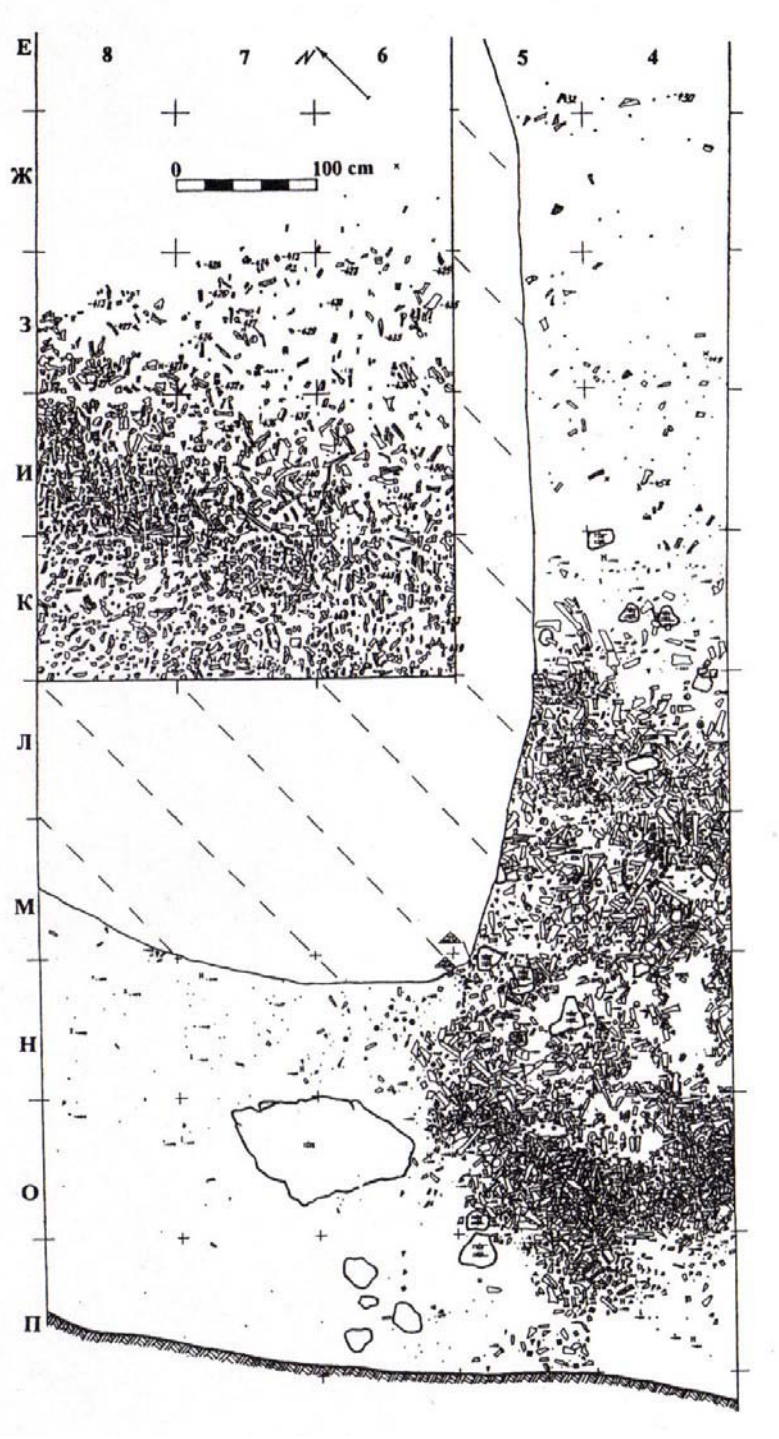


Figure 5.3.1-Horizontal plan of Level II/8 depicting the distribution of artifacts and faunal remains modified from (Chabai 1998b, 179). The hollow area with diagonal dashed lines represents areas destroyed by looters.

With the exception of Levels II/8 and III/2, the results presented here and previous analyses conducted by Patou-Mathis (1999, 2005, 2006a, 2006b) suggest that the season of occupation was generally summer (from late spring to early autumn). This trend remained unchanged

throughout the occupation history of Kabazi II and was apparently unaffected by periods of deteriorating climate and changes in local vegetation (Patou-Mathis 1999, 2005, 2006a, 2006b; Richter 2005; Gerasimenko 2005). The general pattern – i.e., the continued occupation of Kabazi II during climactic downturns - confirms Richter's (2005, 277) hypothesis that the inner chain of the Crimean Mountains served as a natural refugium for both animals and Middle Paleolithic humans. During periods of sudden warming however, occupations at Kabazi II appears to have persisted into winter, as inferred in Levels II/8 and III/2.

	Spring			Summer			Autumn			Winter		
Level	Early	Middle	Late	Early	Middle	Late	Early	Middle	Late	Early	Middle	Late
II/7AB			x	x								
II/7C			x									
II/7D			x	x	x	x	x					
II/7E			x									
II/8			x	x						x	x	
II/8C			x	x								
IIA/1			x									
IIA/2			x	x	x	x	x					
IIA/2-3												
IIA/3-3A-3B			x	x								
IIA/4			x	x	x	x	x					
IIA/4B												
III/1A			x	x	x	x	x					
III/1			x	x	x	x	x					
III/2A			x	x	x	x	x					
III/2			x	x	x	x	x			x	x	x
V/4, V/5, V/6												
VI/1	x	x	x									
VI/2, VI/3, VI/4												
VI/5	x	x	x									
VI/6				x	x	x						
VI/7				x	x	x						
VI/8, VI/9, VI/10												
VI/11-14	x	x	x									
VI/15, VI/16, VI/17												

Table 5.3.2-Summary of results for season of occupation determined by Patou-Mathis (1999, 2006a, 2006b, 2005).

5.4- Anatomic Representation of *Equus hydruntinus*

In all assemblages, with the exception of Level II/13A, limb elements are well represented relative to other anatomic regions based both on the overall relative proportions of identified elements (MNE) and minimum animal units (%MAU). More specifically, elements of the upper front limbs are the best represented in the majority of the assemblages. These include Levels II/2-1, II/2, II/5, II/8, II/9, and II/13. The remainder, Levels II/1, II/3 and II/7 are dominated by elements of the lower hind limbs.

Vertebrae and ribs are generally under-represented in all assemblages however the pelvis dominates most assemblages with the exception of Levels II/3 and II/8.

According to Patou-Mathis (1999, 2005, 2006a, 2006b) this trend towards upper front limb dominated assemblages is seen in all levels from Units V and VI and in Level III/2. The remainder of assemblages from Units III and II appear to be dominated by cranial elements. Patou-Mathis (2005, 2006a, 2006b) attributes the dominance of front limbs in Units V, VI, and Level III/2 to on-site consumption of meat and marrow suggesting that the upper hind limbs and axial skeleton were transported to another location for consumption. Elements of the lower limbs and phalanges are considered to represent selective discard. However in the case of Level II/2 there exists a statistically significant correlation between bone density and survivorship which indicates that element representation cannot be interpreted directly as a result of human action (Grayson 1989). As for Levels II/3 and II/8, based on the analysis of element representation as a function of food utility values (Chapter IV, Figures 4.4.5b & 4.8.5b) a case can be made for selective transport of high utility elements away from the site - presumably to a residential camp – such as Kabazi V, a nearby rock shelter.

Stiner (1991, 1994) suggests that limb dominated assemblages (aka "meaty assemblages") are indicative of a later behavioral adaptation among Neanderthals involving the adoption of ambush hunting tactics in response to climatic deterioration and changes in local vegetation and topography after 55 000 BP (Stiner 1994, 376-377). In addition, Stiner (1994) found that limb dominated assemblages are composed of prime-aged animals at the peak of their

physical condition. In the Levels analyzed here, cranial bones are typically under-represented except for Level II/7 which approaches 40% (Figure 4.7.3a) and limbs are relatively well represented therefore, may indicate the ambush tactics described by Stiner were practiced by the Neanderthals at Kabazi II. This concurs with evidence from other sites in Western Crimea such as Starosel'e (Burke 2000). Furthermore, the age profiles demonstrate that these assemblages are dominated by prime-aged adults and senile individuals are rare (Figure 5.2.1). Neanderthals at Kabazi II, therefore, were primarily hunters – not scavengers.

Furthermore, the anatomic representation, age, and seasonality data presented here does not indicate that the Neanderthals at Kabazi II met their nutritional requirements through scavenging, although it is possible that they may have taken advantage of fresh carcasses during earlier occupations in Unit VI as reported by Patou-Mathis (2005).

5.5-The Humans vs. Carnivores in Assemblage Formation and Alteration

The surfaces of the majority of bones in all assemblages have been altered through weathering and dissolution. As a result, surface modifications such as cut marks and gnaw marks made by animals are largely absent and inferences regarding assemblage forming agents through the analysis of these modifications are extremely limited. However, despite this shortcoming, some human and animal generated modifications have been observed.

5.5.1-Cut Marks

The cut marks examined in this study were produced by stone tools based on macroscopic examination (cf. Lyman 1994, 1987a; Shipman & Rose 1983; Fisher 1995; Behrensmeyer et al 1989). Unfortunately, microscopic examination of their internal characteristics could not be undertaken since nearly all bones analyzed in this study exhibit a high degree of surface erosion. This obliterates microscopic features such as striations and shoulder effects (Gibert & Jimenez 1991, 121).

Aside from the potential difficulty in distinguishing cut marks from non-human surface modifications, there are other pre- and post-depositional factors which may prevent cut marks from showing up on archaeological bone altogether. Stiner (1994, 138-140) claims that cut marks on bone are really a chance occurrence since their appearance is governed by element representation at particular site, skill of the butcher, and tool characteristics which limit the depth of the cut produced. For example, tools made from small pebbles have shorter cutting edges than those produced from larger nodules which produce deeper cuts extending to the bone's surface. Unhafted tools (aka. tools without handles) cannot be applied with as much leverage as hafted tools and are also less effective at producing deep cuts. Encounters with such tissues as muscle, tendon, ligament and the periosteum may buffer direct contact between a tool's cutting edge and the surface of a bone (Lyman 1987a, 2005; Gibert & Jimenez 1991; Shipman & Rose 1983a; Fisher 1995).

Nevertheless, despite all the potential limitations associated with the identification and formation of cut marks, their inclusion in any taphonomic analysis, where possible, strengthens interpretations of human agency in assemblage formation.

Cut marks have been observed in Level II/1, II/5, II/8, II/9 and II/13 where they appear on the remains of *Equus hydruntinus* exclusively. In Level II/1 they appear on the lateral surface of an astralagus, in Level II/5 on a calcaneus, in Level II/8 on the proximal epiphyses of a radius and metacarpal as well as on the mid-shaft of a humerus. In Level II/9, they appear on a pelvis and in Level II/13 on a distal tibia. The cut marks observed in Levels II/1, II/5, and II/13 appear to be the result of severing tendons around joints in order to facilitate the disarticulation of limbs during butchery, whereas the cut marks observed on the humerus in Level II/8 and the pelvis in Level II/9 appear to be the result of defleshing and meat stripping.

5.5.2- Bone Breakage by Humans

The type of bone breakage of interest in this study is spiral fracturing since it can be associated with human induced breakage resulting from the extraction of marrow from fresh bones combined with the presences of flake scars. Mammal bone responds in predictable ways

when stressed as a result of its microstructure, moisture, organic (i.e. collagen), and mineral content (i.e. hydroxyl-apatite). Bones that come from recently killed animals are ductile and can withstand large amounts of strain before breaking. In contrast, bone that has been exposed for a long period of time after an animal's death behaves in a brittle manner and can only take a small amount of strain before breaking (Johnson 1989; Lyman 1994; Reitz & Wing 2008; Fisher 1995).

Among the assemblages analyze here, spiral fractures and flake scars occur simultaneously in 4 cases in Level II/2-1 and in 1 case in Level II/5. These are not levels for which statistical evidence of meat transport is present- indicating the possibility of *in situ* consumption and processing. All of which have been observed either just above or below the middle portion of the diaphysis.

5.5.3-Combustion

The presence of burned bone at an archaeological site, like cut marks, is a direct indicator of human activity since fire is one signature that animals never leave. Unlike cut marks, the identification of burned bone is generally less ambiguous. Concentrations of burned bone may indicate the presence of hearths which define living floors as well as provide valuable information about space use and rates of re-occupation relative to sediment accumulation (Stiner 1994; Chabai & Veselsky 2007; Lyman 1994).

In cultural contexts, most burning of bones is not the direct result of culinary activities. Bone may be burned as the result of waste disposal (Lyman 1994; Stiner 1994; Stiner et al 1995), the use of bone a fuel (Lyman 1994; Stiner 1994; Costamango 2002; Chabai & Veselsky 2007), or it may occur unintentionally from being in close proximity to a hearth (Cain & Hanson 2007; Cain 2005; Lyman 1994; Stiner et al 1995; Stiner 1994). Nevertheless, heating alters bone both in terms of its macrostructure and microstructure, producing key characteristics such as color and texture, as well as changes in its mineral matrix that can be good indicators of the temperature to which a bone was heated, the duration of heating, and the condition of the bone when it was

burned (Marshall 1989; Shipman et al 1984; Cain 2005; Stiner et al 1995; Lyman 1994; Hanson & Cain 2007; Nicholson 1993).

The use of color as a function of temperature may be useful in determining whether or not bone was burned in a natural or man-made fire. Naturally occurring fires tend to superficially and unevenly carbonize a bone whereas bone burned in man-made fires tend to be calcined, since man-made fires generally burn hotter and for a longer duration than naturally occurring ones (Cain 2005; Shipman et al 1984; Lyman 1994). Furthermore, the color of a burned bone may indicate whether or not a bone was burned as a result of culinary activities or waste disposal since flesh insulates bone. As a result, only the exposed portions become discolored. On the other hand, bone burned during waste disposal is generally calcined over its entire surface (Lyman 1994; Nicholson 1993; Stiner et al 1995).

It has been demonstrated that the effects of weathering, acid, and mineral staining can mimic the macroscopic features of burned bone. For instance, badly weathered bone may, at first glance, exhibit similar splitting and the grey to white color of calcined bone (Nicholson 1993; Shipman 1989). Bone that has been stained by humic acids or manganese oxides may adopt a brown or black color similar to lightly burned or scorched bone (Nicholson 1993; Shahack-Gross et al 1997; Binford et al 1986). Several sources (i.e. Stiner et al 1995; Cain 2005; Nicholson 1993; Shahack-Gross et al 1997; Hanson & Cain 2007) state that the best way to overcome these potential ambiguities is to examine the microstructure of the bone in question. Given the small proportion of burned bone identified in this study, burned bone was identified at the macroscopic level only. The six color stages as well as the four texture stages described by Cain (2005, 875-Tables 1 & 2) were employed here.

Evidence of combustion occurs on a small number of bone fragments in Levels II/2 and II/3 all of which are only lightly to moderately carbonized (Color Stages 2 and 3, defined by Cain 2005) suggesting that they may have been situated on the outer periphery of a hearth, confirming that at least some processing and consumption took place on site, despite the fact that II/2 and II/3 show signs of selective transport away from the site. Evidence for the use of fire at Kabazi II occurs in Units V and VI and Levels II/7D, II/8, IIA/1 in the form of burnt bones and

ash scatters reported elsewhere (Chabai 2005; Patou-Mathis 2006a). Furthermore the presence of a hearth has been identified in Level V/3 (Chabai 2005, 22).

5.5.4-The Role of Animals as Agents of Accumulation

A common source of ambiguity in the analysis Middle Palaeolithic faunal assemblages lies in determining is whether or not they represent an accumulation generated by humans, animals or both since human groups throughout the Palaeolithic occupied caves and rock shelters that were also witness to occupation by carnivores and rodents (Niven 2006; Stiner 1994). Large and small carnivores, as well as rodents and raptors form bone accumulations and may disrupt human accumulations through scavenging and digging (Lyman 1994; Hill 1989; Mondini 2002; Blumenschine & Marean 1993; Stiner 1994; Marrin-Arroyo et al 2009; Gifford 1981). The feeding and scavenging behavior of canids such as wolves and hyenas produces bone accumulations and these animals tend to break bones in a similar fashion to humans, as well as removing large quantities of bone from kill sites (Binford 1981; Hill 1989; Stiner 1994; Lyman 1994, 1987a; Blumenschine & Marean 1993).

Rodents such as marmots, rats, and porcupines will collect weathered bones which they gnaw on to supplement nutrients in their diet as well as file down their teeth (Lyman 1994; Shipman & Rose 1983; Gifford 1981; Brain 1981). However, most rodent species with the exception of porcupines (cf. Brain 1981) and small carnivores such as foxes tend to remove only the smallest and lightest bones and form relatively small accumulations when compared to hyenas and wolves (Lyman 1994). Nevertheless, the presence of these species has been documented in the area around Kabazi II (Patou-Mathis 1999, 2005, 2006a, 2006b; Patou-Mathis & Chabai 2003; Markova 1998, 2005; Burke 1999). Therefore, special attention was paid to assessing the role of animals, especially hyenas as possible assemblage formation agents. The presence of carnivore and rodent remains, as well as gnaw marks in addition to patterns of bone breakage was employed since the application of each of these criteria alone is insufficient.

There is some evidence of gnaw marks on bones in Levels II/2-1, II/2, II/9, and II/13. The sample in II/2-1 appears to have been gnawed by a large rodent, possibly a porcupine. Gnaw

marks made by porcupines have been observed on bones in Levels VI/10 and VI/11-14 in Unit VI (Patou-Mathis 2005). The remainder of the gnawed bones bears evidence of furrows and perforations probably generated by hyenas (cf. *Crocuta crocuta*) whose presence is documented in Level II/8 (Patou Mathis) and in the vicinity of Kabazi II at Kabazi V (Burke 1999; Burke et al 1999). Evidence of gastric juice etching is absent throughout which is hardly surprising given the poor surface condition of the bone in all assemblages (below). Some long bones in Levels II/2-1, II/2, II/3, II/7, II/9, II/13 bear evidence of spiral fracturing at or near the epiphyses, a pattern of bone breakage characteristic of human generated assemblages that have been scavenged by hyenas (Lyman 1987a; Blumenschine & Marean 1993; Gifford 1981). The location of the spiral fractures in conjunction with the gnaw marks observed in Levels II/2, II/9, and II/13 puts forth the possibility that carnivores may have contributed to their formation. The majority of long bones in these assemblages exhibit spiral fracturing at locations just above or below the middle portion of the diaphysis. The presence of anthropic surface modifications in Levels II/2-1, II/2, II/8 and II/13 suggests that these spiral fractures represent those generated from marrow breakage.

The presence of a hyena tooth fragment identified in Level II/8 suggests that the material deposited during at least one of the occupations in this level was scavenged by hyenas.

The overall poor representation of carnivore surface modifications (<1% of all modifications, when present), the association of percussion marks with spiral fracture patterns of long bones, and the degree of fragmentation (below) indicates that humans are the most likely agents responsible for the formation of the assemblages studied here. The role carnivores played, although not completely dismissible, was secondary at best. The available artifact inventories for Levels II/1, II/2, II/3, II/4, II/5, II/7, and II/8 (Chabai 2006) and the presence of burned bone in Levels II/2 and II/3 further attest to the anthropic origin of these assemblages. These results concur with the previous analyses conducted by Patou-Mathis (1999, 2003, 2005, 2006a, 2006b).

5.6- The Effects of Plants, Climate, and Diagenesis

5.6.1-Fragmentation

Unidentified bone and tooth fragments in Levels II/2, II/3, II/8, II/13, and possibly II/13A belong to size classes 2 to 3, suggesting that the bone assemblage is relatively fragmentary. Observations made by Patou-Mathis (2006a, 39) on a separate portion of the assemblage from Level II/8 suggest that climate was largely responsible for the secondary fragmentation of this assemblage. In addition to climate, trampling and/or sediment weight may be responsible for some secondary fragmentation of the material. In the case of Level II/8 which represents a palimpsest, abrasion marks have been observed on a small number of samples (N=10), indicating that the effects of trampling may have been responsible for some of the secondary fragmentation observed here.

5.6.2-The Effects of Plants

Plant roots are capable of etching thin, shallow, and curvy lines as well as pits on the surface of bones and teeth (Behrensmeyer 1978; Andrews & Cook 1985; Binford 1981; Lyman 1994; Fisher 1995). This etching is the result of humic acid dissolving the bone's surface either from the growth and decay of the roots themselves or possibly fungi associated with the decomposition of the roots (Behrensmeyer 1978; Lyman 1994; Fisher 1995; Andrews & Cook 1985) however the exact role of both agencies is not clear (Lyman 1994, 375). Nevertheless, root etching occurs after full or partial burial near the ground's surface (Lyman 1994; Behrensmeyer 1978) and at the very least, its presence indicates that the bone sample in question existed in a plant supporting environment for part of its taphonomic history (Lyman 1994; Andrews & Cook 1985). More specifically, the analysis of the distribution root etching may be analytically useful since it is indicative of sediment accumulation history and intensity as well as the general timing of bone fracture and destruction (Behrensmeyer 1978; Lyman 1994; Phoca-Cosmetatou 2002).

For instance, observations made by Grayson (1988, 30) indicate that bones deposited in deep and organically poor strata contain no etched bones whereas bones from shallower strata

were etched. Furthermore, if root etching is present on fracture surfaces or on the internal surfaces of limb bones, it may suggest that the bone was broken before burial (Lyman 1994; Fisher 1995). However, according to Behrensmeyer (1978) roots can grow through a bone's surface and break it apart within the sediment and therefore may result in root etched fracture surfaces as well.

There is very little evidence for root etching on the bones in all of the assemblages studied here. This could be a product of the sediment type in each of the associated strata (7, 8 and 9) which is mostly composed of large sub-angular limestone cobbles, in conjunction with the location of the site (i.e. on a hillside). These factors are not conducive to plant growth regardless of climatic conditions.

5.6.3-Colluvial Transport

Traces of abrasion due to colluvial transport (aka. slope wash) are lacking. As a result, we cannot confirm slope transport of these assemblages as reported by Chabai (1998b). The overall absence of abrasion marks as well as cut marks and gnaw marks, is likely attributable to their deletion by surface erosion caused by weathering and chemical dissolution, however.

5.6.4-The Effects of Weathering

The term "weathering" is applied to natural surface modifications produced from exposure to regionally and temporally specific environmental and climatic factors. As bone weathers, its original organic and inorganic components break down and separate as a consequence of the physical and chemical agents operating either *in situ* on the ground's surface or within the soil zone (Behrensmeyer 1978, 153). This results in cracking, splitting, exfoliation, disintegration and decomposition of a bone's original surface (Lyman 1994; Lyman & Fox 1989; Behrensmeyer 1978; Gifford 1981; Fisher 1995).

The qualitative assessment of the degrees bone weathering gives the most direct informative description of the nature of destruction resulting from the depositional context of an assemblage and climatic conditions in effect during exposure (Behrensmeyer 1978; Lyman 1994;

Lyman & Fox 1989; Phoca-Cosmetatou 2002; Gifford 1981; Fisher 1995). For instance, bone tends to weather more intensely in open air contexts, wherein they are directly exposed to the elements, as opposed to covered environments such as caves and rock shelters (Lyman 1994; Lyman & Fox 1989; Gifford 1981; Burke 1999). In arid climates, bones and teeth tend to crack longitudinally and break apart in long, thin splinters (Behrensmeyer 1978; Behrensmeyer et al 1989; Miller 1989; Lyman 1994; Steele & Carlson 1989). This type of fragmentation may also occur as the result of rapid wetting and drying or freezing and thawing (Gifford 1981, 417).

In addition, Behrensmeyer (1978, 157) concludes that "weathering stages appear to be predictably linked with time of death". In other words, weathering is continuous through time and bone weathers at a constant rate in a given environment. In theory, the analyst could therefore infer the amount of time elapsed since the animal's death and the duration of exposure on the ground's surface.

However, there are many taphonomic factors involved in the formation of a weathered assemblage, some of which cannot be controlled for. For example, weathering does not necessarily cease after a bone is buried. As a result, the temporal end of exposure is difficult to determine (Lyman 1994; Lyman & Fox 1989). Bone weathering may cease altogether at any given stage and not progress to the next even if the local micro-environmental conditions (i.e. moisture, vegetation, shade) do not change (Lyman 1994; Lyman & Fox 1989). Furthermore, the mineral density of different bones within the same animal and among different individual animals of the same species as well as homologous bones of different taxa affect the rates at which they weather since denser bone weather slower than lighter, more porous bone (Gifford 1981; Lyman 1994; Lyman & Fox 1989; Behrensmeyer 1978).

In spite of these limitations, weathering was assessed and evaluated for individual identified bones in order to assess the depositional context as well as climatic conditions in effect during assemblage formation.

The majority of bones in the assemblages studied here demonstrate advanced stages of weathering (Stage 3, defined by Behrensmeyer (1978, 151)). The surface condition of the bones

therefore indicates that each assemblage remained exposed on the ground's surface for a long period of time increasing the chances of scavenging by various animals and attesting to slow rates of sedimentation within the site area (Chabai 2005) as well as affecting the observation of other taphonomic factors.

5.6.5-The Effects of Water

Dissolution

Naturally occurring chemical dissolution, resulting from percolating or dripping water has been observed on a small number of samples from Kabazi II, as small irregular holes or bowl-shaped pits which, as mentioned previously, may mimic effects of gastric juice etching resulting from partial or complete digestion by large carnivores (Phoca-Cosmetatou 2002; Stiner 1994). As a result, this may obscure the role of carnivores as potential assemblage forming agents (but see discussion above). Gastric juice etching only occurs on the smallest elements and covers the entire bone's surface, however. Conversely, water dissolution may occur on any given element and is generally restricted to one part of a bone's surface.

Phoca-Cosmetatou (2002, 137) states that water dissolution only occurs on bone surfaces that have undergone a significant amount of weathering. In heavily weathered bone, insoluble collagen is completely broken down thereby facilitating the dissolution of inorganic hydroxyl-apatite (Brett 1990; Parsons & Bret 1990). This is consistent with our observation of heavy weathering (above). Dissolution resulting from water percolating through the sediment contributed to the poor condition of bone surfaces in all levels, therefore.

Manganese Oxide Staining

One of the most common surface alterations observed at archaeological sites associated with a calcareous geological context, is a brown, mottled grey to black staining caused by the natural enrichment of bone with metal oxides, specifically manganese oxides (Marin-Arroyo et al 2008; Lyman 1994; Gonzalez et al 2005; Shahack-Gross et al 1997). The origin of manganese

coatings is a result of the interplay between the percolation of water through the sediment, its mineral composition, the decay of organic material (i.e. plants or animal remains from human butchering activities), soil pH, and the action of micro-organisms (Gonzalez et al 2005; Marin-Arroyo et al 2008; Shahack-Gross et al 1997).

The observation of the type and degree of oxide staining provides valuable information about the origin and sequence of formation of an archaeological deposit (Gonzalez et al 2005, 707). For instance, observations made by Gonzalez and colleagues (2005, 710-711) on manganese oxide stained bones from Linãres Cave (North-western Portugal) suggest that certain tissues such as tendon and cartilage may inhibit the deposition of manganese oxide on such anatomic locations as articular facies as well as the insertion points of tendons and ligaments. This absence may suggest the preservation of anatomic connections from an animal's death up to the burial of its skeletal remains.

Blackened bones in cave and rock shelter environments may be mistaken for evidence of burning (Marin-Arroyo et al 2008; Gonzalez et al 2005; Shahack-Gross et al 1997; Binford & Stone 1986). The only method for overcoming this potential source of ambiguity is through infra-red spectroscopy and X-ray diffraction (Shahack-Gross et al 1997; Gonzalez et al 2005; Marin-Arroyo et al 2008). Fortunately, Kabazi II is an open air site and all oxide staining observed on the bone and tooth samples appears as easily identified grey spots. Staining by manganese oxides occurs on some bone surfaces in all assemblage and increases in frequency with depth. Furthermore, few blackened bones susceptible of being mistaken for burned rather than manganese-stained bones, were identified in this study.

For an example of the type of manganese oxide staining observed at Kabazi II see Appendix G (Image 3).

5.7-Element Representation and the Treatment of *Equus hydruntinus*

Statistical analyses were conducted on levels with MNI values greater than 4 to assess the relationship between element representation, bone density and food utility. These include Levels

II/1, II/2, II/3, II/5, II/8, and II/13. The results of these analyses indicate that density mediated destruction is not a factor governing element representation for the remains of *Equus hydruntinus* in these assemblages with the exception of Level II/2, where it appears to have played a role (Chapter IV, Figure 4.3.5a).

There is evidence for selective transport in Levels II/2, II/3, and II/8 since there exists a statistically significant, negative relationship between element representation (%MAU) and associated food value (SFUI) when a Spearman's rho test is performed (Chapter IV, Figures 4.3.5b, 4.4.5b, 4.8.5b). This means that high utility elements have been removed from these assemblages as a result of human transport decisions, rather than *in situ* attrition. This result must be tempered in the case of Level II/2 by results of the density correlation which indicates that density-mediated destruction of bone has affected element representation.

The pelvis is a high utility element within the equid body (Outram & Rowley-Conwy 1998) and is well represented in many of the levels. Patou-Mathis (2006a, 2006b, 2005, 2003, 1999) attributes the over representation of the acetabulum and glenoid, in conjunction with the under representation of the proximal humerus and femur as the product of a specific pattern of limb disarticulation, rather than a result of density-mediated bone attrition. However the effects of bone density on element representation were not statistically tested for in these studies. Our results could concur with those of Patou-Mathis for those levels where density mediated destruction is not statistically proven (i.e., with the exception of Level II/2).

It appears that the occupants of Kabazi II occasionally processed and consumed *Equus hydruntinus* remains at the kill site itself or nearby, a pattern similar to that observed by Burke (2000, 328-329) at the Crimean Middle Palaeolithic site of Starosel'e in Level 3. Only three levels (II/2, II/3, and II/8) indicate that Kabazi II served as a primary butchering site with selective meat transport to another location. The comparisons between element abundance and associated meat and marrow weights for Levels II/2, II/3, and II/8 (See Chapter IV, Figures 4.3.5c, 4.3.5d, 4.4.5c, 4.4.5d, 4.8.5c, 4.8.5d), indicate that transport decisions was not influenced by meat or marrow alone. Rather, both were of equal importance as suggested by Outram and Rowley-Conwy (1998).

Since the carcass of an adult *Equus hydruntinus* probably yielded between 108 and 120 kg of meat (Patou-Mathis 1999, 2006a), the occupants of levels II/2, II/3, and II/8 would have nearly a ton's worth of meat to process and transport before it would spoil - bearing in mind that Level II/8 is likely a palimpsest of at least two distinct occupations. This would prove to be a time consuming and physically demanding activity which could explain evidence for some meat and marrow consumption on site. There is no direct evidence of processing activities such as meat drying taking place at Kabazi II.

This is where the evidence from the nearby collapsed rock shelter, Kabazi V must be examined.

5.8- Relation to Kabazi V

Chabai (2008, 523) alludes to the possibility that the Western Crimean Mousterian (WCM) occupations in Unit IV and the sub-units of Level III/3 at Kabazi V may be functionally linked to contemporary occupations at Kabazi II. Given its close proximity to Kabazi II, its inferred function as a base camp and the proposed season of occupation of these units (between spring and autumn) (Burke 1999; Patou-Mathis 2007), Kabazi V could in theory be the final destination for some of the meat transported from Kabazi II. We test this hypothesis here.

The Crimean Micoquian and WCM occupations identified at Kabazi V and represent only a small part of a network of settlements connected with kill and butchery stations in the immediate area (Chabai & Uthmeier 2006; Uthmeier et al 2008). Unlike Kabazi II and other Crimean Middle Paleolithic sites, such as Shaitan Koba and Karabi Tamchin - where the WCM occupations overly those of the Crimean Micoquian, Kabazi V is only site where these two industries are inter-stratified (Yevtushenko 1999). The Crimean Micoquian occupations in Levels III/1, III/2, and III/5 are roughly contemporary with the WCM occupations in Levels II/7 to IIA/1 at Kabazi II and the AMS dates place them within the Hengelo Interstadial, between 40 000 and 38 000 B.P. (Chabai 2006, 2008). The two sites are not likely to have functioned within the same settlement system during this time, therefore.

There may be a functional link between the WCM occupations in Unit IV at Kabazi V and Level IIA/2 at Kabazi II, however. Chabai (2008, 513) suggests these levels are temporally and environmentally analogous. Furthermore, the sub-units of Level III/3 at Kabazi V and Levels II/1 to II/5 at Kabazi II (both associated with the WCM) correspond to Stadial conditions, most likely the Huneborg Stadial (Chabai 2008, 2005).

In order to see how the WCM occupations at Kabazi II and Kabazi V articulate with one another, the results of Patou-Mathis' (2006a) analysis of the assemblage in Level IIA/2 from Kabazi II, and the results presented here for Levels II/1 to II/5 (Patou-Mathis 2007) are compared with faunal results from Unit IV and the sub-units of Level III/3 from Kabazi V. Caution must be exercised, however, since true contemporaneity between the assemblages cannot be determined due to inconsistencies between the AMS and U-series dates for Kabazi V (Chabai 2008, Tables 18-2 & 18-3, 512-513).

According to the analysis of the occupations in Unit IV and Levels III/3-1, III/3-1A, and III/3-3A at Kabazi V (Patou-Mathis 2007), whole *Equus hydruntinus* fore- and hind upper limbs were brought to the site and processed outside the rock shelter for consumption. MNIc values for the levels in Unit VI and most of the sub-units in Level III/3 are too low to provide a sufficient sample size to base any interpretations upon (MNIc = 1). The exception is Level III/3-3A at Kabazi V, where 5 individuals (MNIc = 5) have been identified (Patou-Mathis 2007, 110-Table 6-4).

There is evidence for selective transport occurring in Levels II/2 and II/3 at Kabazi II (See Chapter IV, Figures 4.3.5b and 4.4.5b). In addition, elements of the upper fore- and hind limbs are under-represented in Level II/3 when compared to Level II/2 (See Chapter IV, Figures 4.3.3a and 4.4.3a). If a complimentary relationship does exist between Kabazi II and Kabazi V, the strongest candidates would therefore be Level II/3 at Kabazi II and III/3-3A at Kabazi V bearing in mind that the problems with the dates and the complexity of the settlement system along Kabazi Mountain imposes limits on the certainty of this conclusion.

5.9- Animal Ethology, Landscape use and the Acquisition of Game in the Vicinity of Kabazi II

The immediate area that surrounds Kabazi II is characterized by a mosaic of three different habitat types, the first is steppic grassland situated on the cuesta above the site. The second, a forested river valley as well as a rocky flood plain located below the cuesta, and along the banks of the Alma River, and the third consists of the slopes of the cuesta characterized by sparse, shrubby vegetation, steep rocky hills, and sheer cliffs (Uthmeier 2008, 2005; Chabai & Uthmeier 2006).

The climatic and environmental reconstructions developed though the analysis of pollen (Gerasimenko 2005, 1998), the remains micro-mammals (Markova 1998, 2005), and snails (Mikhailesku 1998, 2005) obtained from the study area, indicate that during the nearly 100 000 year occupation of Kabazi II the climate fluctuated between arid glacial and temperate interstadial conditions. As a result, the vegetation cover of the steppe and river valleys will have changed. Nevertheless, the results presented here and in previous analyses (Patou-Mathis 2006a, 2006b, 2005, 2007, 1998) clearly demonstrate that the availability of *Equus hydruntinus* in the area was generally unchanged since it remained the principal quarry of the occupants of Kabazi II during the summer and early winter months. The only departure from this pattern of seasonal exploitation of this species are the winter kills in Levels II/8 and III/2 which could be associated with periods of warming and increased precipitation at the onset of the Hengelo and Odderade Interstadials at around 40 000 and 54 000 B.P. respectively (Patou-Mathis 2006b, 2006a,; Chabai 2005, Table 1-1).

The closest living relatives of *Equus hydruntinus* are the Asiatic wild asses (*Equus hemionus*) which currently inhabit the temperate steppes and semi deserts of Mongolia, Kazakhstan, Turkmenistan, India, and Iran (Burke et al. 2003; Orlando et al. 2006). The kulans of Mongolia and Central Asia are a good model for patterns of behavior for *Equus hydruntinus* in Crimea during the Paleolithic (Burke 2006, 2008). It would therefore seem logical to use the social, feeding and escape behavior of kulans to infer how the Neanderthals may have hunted *Equus hydruntinus* at Kabazi II.

Kulans are well adapted to flat and hilly uplands and the foot hills of mountains in steppe and semi-desert settings (Baskin & Danell 2003; Feh et al 2001; Rubenstein & Saltz 1995). During the Palaeolithic, *Equus hydruntinus* inhabited steppic and mountainous environments of the Crimean Peninsula and their seasonal movements and range sizes will have been governed by environmental controls (Burke et al. 2008). The basic type of social behavior demonstrated by kulan is defined as "Type II" (Linklater 2000, 12). Generally speaking, this means that kulan populations are thinly dispersed with little or no social cohesion and males establish territories near food and water sources during the breeding season (in spring and early summer) rather than forming harems. Kulans are known to migrate over long distances and exploit a wider variety of plant species than horses (Bahloul et al 2001; Kaczensky et al 2008). As a result, kulans do not maintain territories for most of the year with the exception of breeding season in late May or June.

In summer, water becomes increasingly important and females, in particular, locate no more than 10 to 15 km from a water source (Baskin & Danell 2003; Feh et al 2001; Bahloul et al 2001). This is a time of year when daily movements would have been most predictable, therefore whereas in winter, they are less tied to water and their range use is greatly expanded (Burke 2006, 65; Burke et al. 2008). During the day, kulans spend their time grazing in open grass land where they form loose congregations that may exceed 800 individuals (Feh et al 2001; Bahloul et al 2001). During the evening, small groups will leave the large congregation and migrate down slope to graze on the lush vegetation found in river valleys only to return to the grassland in the early morning (Feh et al 2001; Bahloul et al 2001; Baskin & Danell 2003; Burke 2006). Kulans are well adapted to moving on slopes with gradients of up to 70° (Baskin & Danell 2003, 11) which they will ascend or descend by contouring (Denzau & Denzau 1999).

It would therefore seem likely that the occupants of Kabazi II ambushed *Equus hydruntinus* as they moved along the slope beneath the site during early morning and evening hours since their ability to flee would be dramatically reduced. In the open, kulans are very fast runners and may achieve speeds between 60 and 85 km/h when in full flight (Baskin & Danell 2003; Burke 2006). This would have made hunting them on the open steppe above next to impossible. Given the site's location (i.e. high up on a slope) the limestone slab could have

served as a natural hunting blind, Kabazi II would have been the ideal location for ambushing *Equus hydruntinus* during their daily migrations. The seasonality data presented here could support the summer movements of the kind described by several authors (i.e. Feh et al 2001; Bahloul et al 2001; Baskin & Danell 2003). However, it could also support the hypothesis proposed by Burke et al. (2008), whereby the slopes and relatively forested flanks of the Crimean Mountains would have provided shelter for herds of *Equus hydruntinus* in their winter ranges when wind chill and inclement weather may have made their movements more predictable and brought them within range of sites such as Kabazi II, Kabazi V, Starosel'e and also Karabi Tamchin. The topography of the region dictated the targeted hunting of equids at several of these sites (Burke et al. 1999).

In addition to the remains of *Equus hydruntinus,* other species are identified among the assemblages at Kabazi II although their relative abundance is very low. These taxa likely represent opportunistic, encounter based kills which satisfied the nutritional demands of the Neanderthals while they waited to be successful in obtaining *Equus hydruntinus*.

It would seem likely that red deer (*Cervus elaphus*) were encountered and killed in the forested river valley below the site since they are commonly associated with forest-steppe boundaries or patch forest habitats (Baskin & Danell 2003; Flerov 1952; Clutton-Brock et al 1982; Clutton-Brock & Albon 1989; Mitchell et al 1977). Their presence has been noted in Levels II/1, II/3, II/5, II/8 and II/13. According to the results of the palynological studies conducted by Gerasimenko (2005) the stratum associated with levels II/1, II/3, and II/5 (Stratum 7) formed under the cold and dry conditions of the Huneborg Stadial when forest cover in the area was nearly absent (Gerasimenko 2005, 39). Uthmeier and colleagues (2008, 496-497) propose that an alternative location to acquire red deer during this time could have been in the neighboring river valley situated 5km away at the confluence of the Alma and Bodrak Rivers which would have remained forested at this time. This claim is loosely supported by the fact that the red deer elements in these levels include whole fore and hind limbs which suggests that Neanderthals at Kabazi II were transporting whole limbs from some distance to the site during the occupation of Levels II/1, II/3, and II/5.

During the summer the ranges of male and female red deer are spread out over larger areas (Baskin & Danell 2003; Flerov 1952; Clutton-Brock et al 1982; Clutton-Brock & Albon 1989; Mitchell et al 1977; Houston 1982). Furthermore, male and female red deer are extremely wary during the summer and will flee at the slightest disturbance since the antlers of males are still covered in velvet and females with fawns are generally more vulnerable (Baskin & Danell 2003; Clutton-Brock et al 1982; Mitchell et al 1977). The rutting grounds and winter pastures of red deer are generally found at lower elevations such as valleys and river drainages however (Baskin & Danell 2003; Flerov 1952; Clutton-Brock et al 1982; Clutton-Brock & Albon 1989; Mitchell et al 1977; Houston 1982). In autumn both males and females are in peak body condition, although males become very aggressive and will even charge humans in defense of their harems (Clutton-Brock & Albon 1989; Mitchell et al 1977; Houston 1982). On the other hand, young males, defeated and injured adult males, as well as very old individuals will occupy the peripheries of the autumn rutting grounds making them more vulnerable to predation (Clutton-Brock & Albon 1989; Mitchell et al 1977; Baskin & Danell 2003). The presence of a very worn adult tooth in Level II/13 (Chapter IV, above) suggests that the Neanderthals of Kabazi II may have opportunistically exploited the vulnerability of these animals when they encountered them. The seasonality data for Levels II/1, II/3, II/5, II/8, and II/13 does not directly indicate whether these red deer were killed during the summer or autumn. Predation during the autumn rut is speculative at best – however it would roughly coincide with the timing of the equid kills.

The large bovid remains in Levels II/2-1, II/8, and II/13A, likely represent those of steppe bison (*Bison priscus*) as opposed to aurochs *(Bos primigenius).* Patou-Mathis (2005) does not exclude the possibility of aurochs in the area especially during warmer periods as seen during the formation Units V and VI, however. The archaeological (cf. Delpeche 1999; Julien 2009; David & Fosse 1999; Brugal 1999) and osteometric evidence (cf. Starkin 1999; Brugal 1999; Julien 2009) suggests that steppe bison are well adapted to open and cold landscapes. However, they are better able to cope with periods of climatic instability which may have prevailed during the formation of Units III, IIA and II at Kabazi II (Gerasimenko 2005; Markova 2005; Mikhailesku 2005) than aurochs (Delpeche 1999; Julien 2009).This versatility would therefore make steppe

bison the more suitable candidate for the large bovid remains in these assemblages (cf. Patou-Mathis 2006a, 2006b).

Evidence from the open air Middle Paleolithic site of Mauran (Southern France) indicates that Neanderthals were capable of ambushing bison herds. David and Fosse (1999, 124-125) determined that the majority of bison remains represent small herds of females accompanied by calves a minority (22-12%) of males represent predation upon isolated males and bachelor herds. Bachelor herds and solitary males occur in the summer or late autumn outside the rut (Brugal 1999). Given the small numbers of individuals involved Bison remains in Levels II/8 and II/13A, likely represent isolated kills, opportunistically encountered on the steppe above Kabazi II.

Adaptations to forested habitats as seen in European bison (*Bison Bonasus*) and North American wood bison *(Bison bison athabascae)*, represents a later adaptation of plains dwelling bison to forested environments during the Holocene (Baryshnikov 1999, 328-329) this would make their procurement in the Alma River Valley unlikely and incidentally explain their low representation in the Kabazi II assemblages.

Wild pig (*Sus scrofa*) was identified in Level II/3 on the basis of an isolated tooth. It seems likely that wild pigs were hunted along the flood plain of the Alma River when encountered since this species prefers forest cover. Wild pigs are generally found humid and temperate climate settings (Baskin & Danell 2003). The weak presence of alder near Kabazi II at the time of formation of Level II/3 (Gerasimenko 2005) supports the existence of some forest cover in the area suitable for wild pig habitat.

Saiga antelope (*Saïga tatarica*) is present in Levels II/2-1, II/5, II/7, and II/13 and also present in levels analyzed by Patou-Mathis (2006a, 2006b, 2005, 2007, 1999). Saiga are exclusively found in steppe and semi-desert environments today (Bannikov et al 1961; Bekenov et al 1998). This would imply that they were probably numerous on the steppe above the cuesta. Saiga are capable of achieving speeds between 60 and 65 km/h when fleeing predators in these open environments, they can spot an approaching human at a distance of nearly 400m (Baskin & Danell 2003; Bannikov et al 1961). It seems likely, therefore, that the Neanderthals at Kabazi II

were hunting Saiga using ambush tactics. Water sources only become important for saiga during the summer when the water content of the local vegetation is greatly depleted (Bannikov et al 1961; Bekenov et al 1998; Formozov 1966). As a general rule, however, saiga avoid dense thickets or areas with broken, rocky, or hilly terrain where their view may be obstructed and their movement limited (Bekenov et al 1998; Bannikov et al 1961) although they will venture into these areas in search of water or in response to bad winter weather (Bannikov et al 1961; Bekenov et al 1998; Baskin & Danell 2003). This would explain the small number of individuals identified here, as the area around Kabazi II would have been unsuitable – however, the relative proportion of saiga at the nearby site of Kabazi V (Burke 1999) indicates that the more likely explanation is that Kabazi II was a location form which *Equus hydruntinus* was specifically targeted by Neanderthals.

Ibex (*Capra ibex*) is identified in Level II/2-1. The remains of Ibex are extremely rare however, which is likely the result of their local scarcity and small sample sizes.

The remains of carnivores such as hyena (*Crocuta crocuta*) in Level II/8 as well as cave lion (*Pantera leo spelaea*), bear (*Ursus sp*), canids (*Canis lupus* and *Cuon alpinus*), mustelid (*Mustela sp.*) and fox (*Vulpes vulpes* or *Alopex lagopus*) are represented in some of the assemblages analyzed by Patou-Mathis (1999, 2005, 2006a, 2006b) - these likely represent species that were not hunted by the Neanderthals of Kabazi II. Rather, they are likely to represent the remains of intrusive scavengers that may have occupied the site shortly after the humans left. This trend is not uncommon for Palaeolithic sites (Niven 2006; Stiner 1994; Fosse 1995). A single hyena individual is attested in this analysis, in Level II/8.

It is not clear if the remains of large rodents such as the marmot (*Marmota* cf. *bobac*) identified in Level II/7 and the suspect hare (*Lepus sp.*) identified by Patou-Mathis (2006a) represent species that were hunted by the occupants of Kabazi II or not, since no anthropic modifications have been observed on their remains (Patou-Mathis 2006a). This leaves open the possibility that they may represent the kills of other predators such as those mentioned above.

Finally, the remains of megafauna such as wooly rhino (*Coleodonta antiquitatis)* and giant deer (*Megaloceros giganteus)* identified by Patou-Mathis (1999, 2005, 2006a, 2006b) likely represent the remains of scavenged animals since it has been documented that their bones were used as fuel by Neanderthals in the absence of wood (Chabai & Veselsky 2007; Niven 2006; Richter 2006). No megafaunal remains were identified in this study, which could well be a reflection of sample size.

VI-Concluding Remarks

The results obtained from the analysis of Levels II/1, II/2-1, II/2, II/3, II/4, II/5, II/7, II/8, II/9, II/13, and II/13A successfully complete and complement the existing information regarding the subsistence practices at Kabazi II by testing the following hypotheses: the first is Richter's (2005, 277) proposal that the unchanging economic and functional patterns observed over the long occupational sequence at Kabazi II is directly attributed to the sheltered location of the inner chain of the Crimean Mountains. This made it a natural refugium for animals and Middle Paleolithic humans. The second is Patou-Mathis' (2006a, 2006b, 2005, 2003, 1999) interpretation that Kabazi II served as a kill and butchery site throughout its occupational history at which Neanderthals practiced the specialized hunting of *Equus hydruntinus.* The third hypothesis suggests functional link between Kabazi II and the nearby rock-shelter, Kabazi V as suggested by Chabai (2008, 523).

The seasonality data presented here suggests that small groups of equids, likely composing mostly of female *Equus hydruntinus* accompanied by their foals, were ambushed as they moved between the steppe and Alma River during daily movements. This occurred over a period from mid-summer to early winter. In the case of Level II/8 (and possibly II/5) the site was also occupied in winter. In Level II/3, the period of occupation may have included the early summer. The results for Level II/5 suggest that occupation of the site may have occurred earlier in the year than in other assemblages.

The general pattern of seasonality observed at Kabazi II (i.e. between the mid-summer and early winter) is most likely due to the topography of the study area. The internal chain of the Crimean Mountains represents a region sheltered by the coastal and northern chains. As a result, the western portion of the internal chain does not receive much precipitation over the year, especially in winter (Ferring 1998). Since *Equus hydruntinus* like the Asiatic asses (*Equus hemionus*), would have been intolerant of deep snow (Burke 2006, 2008) the internal range may have served as a winter refuge zone. In summer, the Alma River may have attracted *Equus hydruntinus* as dry conditions set in elsewhere. In other words, Kabazi Mountain may have

represented a seasonally stable habitat which was responsible for the unchanging economic and subsistence patterns of its occupants as suggested by Richter (2005, 277).

The location of the study area and ethology of *Equus hydruntinus* may further explain the behavioral resilience of the Neanderthals at Kabazi II. Asiatic asses (*Equus hemionus*) are well adapted to flat hilly uplands as well as mountain foot-hills of both semi-desert and temperate steppe environments. Like Asiatic asses, *Equus hydruntinus* would have been capable of exploiting a broader variety of plant species than caballoid horses. The climatic oscillations and resultant changes in vegetation cover reported over the extensive occupation of Kabazi II suggests a gradual transition from temperate meadow-steppe to semi desert and grassland conditions (Gerasimenko 2005). This transition would have had very little effect on the availability of *Equus hydruntinus* in the area around Kabazi II throughout the Middle Paleolithic.

The element representation observed for equids suggest that Kabazi II was a hunting stand and/or kill and butchery site over the course of the Western Crimean Mousterian occupations. In Levels II/3, and II/8 the site operated as a near-kill processing locality from which selective transport of meat, occurred-possibly towards a residential camp. In the case of Level II/2, the pattern of element representation was influenced by density-mediated bone attrition and apparent evidence of selective transport cannot therefore be safely interpreted as such. Other levels may represent near-kill residential sites as there is no evidence of selective transport. Nevertheless, despite these differences in site use observed over the course of these occupations, the results of the present study concerning site function concur with Patou-Mathis' (1999, 2006a, 2006b, 2005, 2003) statement that the characteristics of Kabazi II itself made it made an ideal location to intercept and butcher *Equus hydruntinus*.

Given its position along the mountain slope behind a large limestone block, Kabazi II would have been a good vantage point and a blind behind which the Neanderthals could observe small herds of *Equus hydruntinus* as they traversed the slopes of Kabazi Mountain. Furthermore, the area behind the block represents the only level surface on the slope upon

which a group could work or be camped. This would explain why the Neanderthals hunted *Equus hydruntinus* at or very near the site of Kabazi II and butchered them on the spot.

As mentioned above, some shifts in the pattern of site occupation have been observed. For instance, during the occupation of Levels II/1, II/5, and II/13 Kabazi II likely served as both a butchering station and temporary campsite whereas during the occupation of Levels II/2, II/3, and II/8 it had served as a primary butchering station at which *Equus hydruntinus* was processed and then, in the case of Levels II/3 and II/8 carried to an off-site location. It is possible that during the occupation of Level II/3 this location was the nearby rock-shelter Kabazi V as indicated by element representation data presented above. To date, this study has come the closest to establishing a functional relationship between Kabazi II and Kabazi V as suggested by Chabai (2008, 523).

To conclude, the results presented herein, in conjunction with previous analyses of Kabazi II (Patou-Mathis 1999, 2006a, 2006b, 2005, 2003) present a pattern of enduring stability throughout the nearly 100 000 years Kabazi II had been in use despite shifts in lithic industry, climate, and local vegetation. Some evidence of scavenging is present but the assemblages studied here are clearly anthropic in origin. The pattern of functional stability demonstrated at Kabazi II supports the hypothesis that Neanderthals were adept hunters capable of single species (Burke 2001) as soon as they settled the region, an event which occurs as early as OIS sub-stages 5e and 5d (Hoffecker 2000).

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Appendix A-List of Abbreviations

In Catalogue:

Column Headers

CAT#-Catalogue Number

BAG#-Bag Number

SQUARE-Refers to the excavated grid square

QTY-Quantity

ELEMENT-Refers to the name of the bone identified

SIDE-Refers to the anatomic side

% PORTION REPRESENTED-Refers to the level of completeness of a particular portion of the element

CODE FOR PART- Applies to long bones and specific anatomic locations represented (See Chapter III).

SPECIES/CATEGORY- Refers to the identification of species or class.

CUT-Refers to cut marks

E.DAM-Refers to excavation/preparation damage

BURNED-Refers to traces of combustion

Species

EHYD-*Equus hydruntinus*

EQUUS SP.-Equid cf. *Equus hydruntinus*

CERVUS ELAPHUS-Red deer

PERC.-Refers to flake scarring

G.FRACT.-Refers to spiral fracturing

GN-Refers to gnaw marks

POLI-Refers to gastric juice etching

ETCHED-Refers to root etching

TRAMP-Refers to abrasion marks

WS-Refers to observed weathering stage(s)

DISS-Refers to water dissolution

OXIDE-Refers to Manganese oxide staining

AGE TEEH: **1**-Crown height on buccal surface
2-Crown height on lingual surface
X-Maximum crown width
Y-Maximum crown length
POINT P-Refers to crown height from the "point p"

AGE-Refers to the specific age in months or years

GEN AGE-Refers to the general age category

BOS SP.-Bison

SAIGA-Saiga antelope

IBEX-Ibex

SAR-Small artiodactyls cf. saiga antelope

LAR-Large artiodactyls

CROCUTA-Hyena

MARMOTA SP.-Marmot cf. bobac

SUS SP.-Wild Pig

LARGE MAMMAL

SMALL MAMMAL

Elements

SCAP-Scapula
HUM-Humerus
RAD-Radius
ULN-Ulna
CAR-Carpal
MCAR-Metacarpal
MCII & MCIV-Vestigial metacarpals
APH-1st phalanx
BPH-2nd phalanx
CPH-3rd phalanx
FEM-Femur
PAT-Patella
TIB-Tibia
TAR-Tarsals
CALC-Calcaneus
AST-Astralagus
MTAR-Metatarsal
MTII & MTIV-Vestigial Metatarsals
SES-Sesmoids

CRAN-Cranial bones
PET-Petrous bones
BTOOTH-Buccal tooth
CTOOTH-Cheek tooth
MAX-Maxilla
MAND-Mandible
ATLAS-1st Cervical vertebra
AXIS-2nd Cervical vertebra
AV-Cervical vertebrae (3-7)
BV-Thoracic vertebrae
CV-Lumbar vertebrae
DV-Caudal Vertebrae
SAC-Sacrum
RIB-Ribs
PEL-Pelvis
VERT-Unidentified Vertebrae
MPOD-Unidentified Metapodial

Quantitative Units:

NISP-Number of Identified Specimens
MNE-Minimum Number of Elements
MNI-Minimum Number of Individuals

MAU-Minimum Number of Animal Units
Qsp-The Specific Coefficient

Data Point Labels:
Element Representation and Density

P.Hu-Proximal Humerus

DV- Caudal Vertebrae

Hy- Hyoid

P.Fe-Proximal Femur

Sac- Sacrum

D.Hu- Distal Humerus

P.Ti- Proximal Tibia

D.Fe- Distal Femur

BV- Thoracic Vertebrae

AV 3-7- Cervicals 3-7

PuS- Pubic Symphysis

D.Ra- Distal Radius/Ulna

Pu- Pubis

P.Ra- Proximal Radius/Ulna

CoC- Corpus Calcanei

CV- Lumbar Vertebrae

Ri- Ribs

D.Ti- Distal Tibia

Cu- Cuboid

AX- Axis

AT- Atlas

P.APH- Proximal 1st Phalanx

CPH-3rd Phalanx

Lu- Lunate

I.Man- Intermediate Mandible

I.Fe- Intermediate Femur

D.BPH- Distal 2ndPhalanx

D.MT- Distal Metatarsal

Fib- Fibula

I.Hu- Intermediate Humerus

P.MC- Proximal Metacarpal

Cun- Cuneiform

Sd- Scaphoid

D.MC- Distal Metacarpal

SuT.- Sustentaculum Tali

P.BPH- Proximal 2nd Phalanx

Cap- Capitate

Scap- Scapula

Ram- Ramus

MCII- Vestigial Metacarpal II

Ace- Acetabulum

Ast- Astralagus

P.MT- Proximal Metatarsal

I.APH- Intermediate 1st Phalanx

D.APH- Distal 1st Phalanx

I.Plat- Incisial Platform

ILL- Ilium

Nav- Navicular

P.Ant- Process Anterior

MCIV- Vestigial Metacarpal IV

I.MT- Intermediate Metatarsal

I.Ti- Intermediate Tibia

Isc- Ischium

MTIV- Vestigial Metatarsal IV

I.Ra- Intermediate Radius/Ulna

I.MT- Intermediate Metacarpal

MTII- Vestigial Metatarsal II

M.Hin- Mandibular Hinge

PET- Petrous Bones

Element Representation and SFUI, Meat Weight Index, Marrow Weight Index

Skull-Skull

Mand- Mandible

AT/AX- Atlas/Axis

AV3-7- Cervicals 3-7

Thorax- Thorax

CV- Lumbar Vertebrae

Pel- Pelvis

Scap- Scapula

P.Hu- Proximal Humerus

D.Hu- Distal Humerus

P.Ra- Proximal Radius/Ulna

D.Ra- Distal Radius

P.Mc- Proximal Metacarpal

D.Mc- Distal Metacarpal

Car- Carpals

P.Fe- Proximal Femur

D.Fe- Distal Femur

P.Ti- Proximal Tibia

D.Ti- Distal Tibia

P.Mt- Proximal Metatarsal

D.Mt- Distal Metatarsal

Tar- Tarsals

APH-1st phalanx

BPH-2nd phalanx

CPH-3rd phalanx

Appendix B-Definition of Body Regions

- **The Cranial Skeleton** includes cranial bones, mandibles, isolated upper adult and deciduous teeth as well as isolated lower adult and deciduous teeth.
- **The Axial Skeleton** includes all vertebrae, ribs, sternum, and the pelvis.
- **The Upper Front Limbs** includes the scapula, humerus, and radius/ulna.
- **Lower Front Limbs** includes the 3rd metacarpal, the vestigial metacarpals, carpals, and sesamoids.
- **The Upper Hind Limbs** includes the femur, tibia, and patella.
- **The Lower Hind Limbs** includes the 3rd metatarsal, the vestigial metatarsals, tarsals, and sesamoids.
- **The Extremities** includes the 1st, 2nd, and 3rd phalanges as well as sesamoids.

Appendix C-Raw Figures for the Remains of *Equus Hydruntinus*

Level II/1

Element	NISP	%NISP	MNE	MNI	Qsp	MAU	%MAU
Scapula	1	1	1	1	2	0.5	16.7
Humerus	8	8	4	3	2	2	66.7
Radius/ulna	3	3	2	1	2	1	33.3
Upper front limbs	**12**	**9**	**7**	**3**	**6**	**1.16**	**37**
Femur	3	3	2	1	2	1	33.3
Tibia	6	6	2	1	2	1	33.3
Patella	0	0	0	0	2	0	0
Upper hind limbs	**9**	**7**	**4**	**1**	**6**	**0.66**	**22**
Metacarpal III	7	7	3	2	2	1.5	50
Vestigial (MCII + MCIV)	2	2	2	1	4	0.5	16.7
carpals	1	1	1	1	14	0.07	2.3
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**10**	**8**	**6**	**4**	**24**	**0.25**	**8.3**
Metatarsal III	15	15	6	4	2	3(max)	100
Vestigial (MTII + MTIV)	2	0	2	1	4	0.5	16.7
Tarsals	29	29	19	7	12	1.6	53.3
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**46**	**35**	**27**	**7**	**22**	**1.23**	**41**
1st phalanx	15	15	7	2	4	1.75	58.3
2nd phalanx	4	4	2	1	4	0.5	16.7
3rd phalanx	1	1	1	1	4	0.25	8.3
Sesmoids	0	0	0	0	4	0	0
Extremities	**20**	**15**	**10**	**2**	**16**	**0.62**	**21**
Vertebrae	4	4	4	1	31	0.13	4.3
Ribs	0	0	0	0	36	0	0
Pelvis	11	11	5	3	2	2.5	83.3
Axial skeleton	**15**	**11**	**9**	**3**	**72**	**0.12**	**4**

Isolated Upper Adult Teeth	5	5	5	7	20	0.25	8.3
Isolated Upper Deciduous Teeth	3	3	3	1	12	0.25	8.3
Isolated Lower Adult Teeth	11	11	12	2	20	0.6	20
Isolated Lower Deciduous Teeth	0	0	0	0	12	0	0
Cranium	0	0	0	0	1	0	0
Mandibles	**0**	**0**	**0**	**0**	**4**	**0**	**0**
Cranial skeleton	**20**	**15**	**20**	**7A;1J**	**45 A; 29 J**	**0.38 A;0.1 J**	**12.7 A;3.3 J**

Total MNI=8; 7 Adults, 1 juvenile

Level II/2-1

Element	**NISP**	**%NISP**	**MNE**	**MNI**	**Qsp**	**MAU**	**%MAU**
Scapula	3	4	3	2	2	1.5	60
Humerus	5	6	3	3	2	1.5	60
Radius/ulna	5	6	2	1	2	1	40
Upper front limbs	**13**	**16**	**8**	**3**	**6**	**1.3**	**52**
Femur	3	4	1	1	2	0.5	20
Tibia	6	8	3	2	2	1.5	60
Patella	0	0	0	0	2	0	0
Upper hind limbs	**9**	**12**	**4**	**2**	**6**	**0.67**	**27**
Metacarpal III	6	8	3	3	2	1.5	60
Vestigial (MCII + MCIV)	0	0	0	0	4	0	0
carpals	2	2	2	1	14	0.14	5.6
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**8**	**10**	**5**	**3**	**24**	**0.21**	**8.4**
Metatarsal III	9	11	5	3	2	2.5 (max)	100
Vestigial (MTII + MTIV)	1	1	1	1	4	0.25	10
Tarsals	7	9	7	3	12	0.6	24
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**17**	**21**	**13**	**3**	**22**	**0.6**	**24**
1st phalanx	1	1	1	1	4	0.25	10

2nd phalanx	1	1	1	1	4	0.25	10
3rd phalanx	2	2	2	1	4	0.5	20
Sesmoids	0	0	0	0	4	0	0
Extremities	**4**	**4**	**4**	**1**	**16**	**0.25**	**10**
Vertebrae	3	4	3	1	31	0.1	3
Ribs	0	0	0	0	36	0	0
Sternum	0	0	0	0	0	0	0
Pelvis	9	12	5	3	2	2.5(max)	100
Axial skeleton	**12**	**16**	**8**	**3**	**69**	**0.12**	**3**
Isolated Upper Adult Teeth	10	14	9	1	20	0.45	18
Isolated Upper Deciduous Teeth	0	0	0	0	12	-	-
Isolated Lower Adult Teeth	5	6	5	1	20	0.25	10
Isolated Lower Deciduous Teeth	0	0	0	0	12	-	-
Cranial Bones	1	1	1	1	1	1	40
Mandibles	0	0	0	0	4	0	0
Cranial skeleton	**16**	**21**	**15**	**1A**	**45 A;29J**	**0.33A;0J**	**13.2A;0J**

Total MNI=3 adults

Level II/2

Element	**NISP**	**%NISP**	**MNE**	**MNI**	**Qsp**	**MAU**	**%MAU**
Scapula	8	4.5	4	4	2	2	42
Humerus	8	4.5	3	2	2	1.5	32
Radius/ulna	13	7	5	3	2	2.5	53
Upper front limbs	**29**	**16**	**12**	**4**	**6**	**2**	**42**
Femur	4	2	2	1	2	1	21
Tibia	3	2	2	1	2	1	21
Patella	0	0	0	0	2	0	0

Upper hind limbs	**7**	**4**	**4**	**1**	**6**	**0.67**	**14**
Metacarpal III	13	7	4	3	2	2	42
Vestigial (MCII + MCIV)	4	2	4	1	4	1	21
carpals	1	1	1	1	14	0.07	1.5
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**18**	**10**	**9**	**3**	**24**	**0.38**	**8**
Metatarsal III	13	7	5	4	2	2.5	53
Vestigial (MTII + MTIV)	3	2	3	1	4	0.75	16
Tarsals	32	18	26	10	12	2.16	45
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**48**	**27**	**34**	**10**	**22**	**1.4**	**29**
1st phalanx	21	12	19	1Y	4	4.75 (max)	100
2nd phalanx	9	5	9	3	4	2.25	47
3rd phalanx	3	2	3	1	4	0.75	16
Sesmoids	0	0	0	0	4	0	0
Extremities	**33**	**19**	**31**	**2A;1Y**	**16**	**1.94**	**41**
Vertebrae	7	4	6	2	31	0.19	4
Ribs	0	0	0	0	36	0	0
Pelvis	13	7	8	4	2	4	84
Axial skeleton	**20**	**11**	**14**	**4**	**69**	**0.2**	**4.2**
Isolated Upper Adult Teeth	16	9	16	2	20	0.8	17

Isolated Upper Deciduous Teeth	3	2	3	1	12	0.25	5
Isolated Lower Adult Teeth	3	2	3	1	20	0.15	3
Isolated Lower Deciduous Teeth	1	1	1	1	12	0.08	2
Cranial Bones	2	1	1	1	1	1	21
Mandibles	1	1	1	1	4	0.25	5.2
Cranial skeleton	**26**	**15**	**24**	**2A;1J**	**45A;29J**	**0.47A;0.14J**	**10 A;3J**

Total MNI=11; 9 Adults, 1 Juvenile, 1Yearling

Level II/3

Element	**NISP**	**%NISP**	**MNE**	**MNI**	**Qsp**	**MAU**	**%MAU**
Scapula	2	1	2	1	2	1	15
Humerus	3	1	2	1	2	1	15
Radius/ulna	6	3	3	2A;1Y	2	1.5	22
Upper front limbs	**11**	**5**	**7**	**1A;1Y**	**6**	**1.17**	**17**
Femur	7	3	4	2	2	2	30
Tibia	3	1	2	2	2	1	15
Patella	0	0	0	0	2	0	0
Upper hind limbs	**10**	**5**	**6**	**2**	**6**	**1**	**15**
Metacarpal III	10	5	6	-	2	3	44
Vestigial (MCII + MCIV)	1	1	1	1	4	0.25	4
carpals	3	1	3	1	14	0.21	3.1
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**14**	**7**	**10**	**1**	**24**	**0.42**	**6.2**
Metatarsal III	25	12	9	7	2	4.5	67
Vestigial (MTII + MTIV)	4	2	4	2	4	1	15
Tarsals	34	17	29	7	12	2.4	35
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**63**	**31**	**42**	**7**	**22**	**1.75**	**26**
1st phalanx	31	15	27	-	4	6.75 (max)	100

2nd phalanx	4	2	4	-	4	1	15
3rd phalanx	8	4	8	-	4	2	30
Sesmoids	0	0	0	-	4	0	0
Extremities	**43**	**21**	**39**	**-**	**16**	**2.4**	**36**
Vertebrae	5	2	5	2	31	0.16	2.3
Ribs	0	0	0	0	36	0	0
Pelvis	10	5	5	4	2	2.5	37
Axial skeleton	**15**	**7**	**10**	**4**	**69**	**0.14**	**2.1**
Isolated Upper Adult Teeth	30	15	30	2	20	1.5	22
Isolated Upper Deciduous Teeth	3	1	3	1J;1Y	12	0.25	4
Isolated Lower Adult Teeth	13	7	13	3	20	0.65	10
Isolated Lower Deciduous Teeth	0	0	0	0	12	0	0
Cranial Bones	2	1	1	1	1	0.07	1
Mandibles	0	0	0	0	4	0	0
Cranial skeleton	**48**	**24**	**47**	**3A;1J;1Y**	**45A;29J**	**0.98A;0.1J**	**14.5A;1.4J**

Total MNI=7; 5 Adults, 1 juvenile, 1 yearling

Level II/5

Element	**NISP**	**%NISP**	**MNE**	**MNI**	**Qsp**	**MAU**	**%MAU**
Scapula	3	3	2	2	2	1	45
Humerus	7	6	4	3	2	2	90
Radius/ulna	6	5	3	2	2	1.5	68
Upper front limbs	**16**	**14**	**9**	**3**	**6**	**1.5**	68
Femur	1	1	1	1	2	0.5	23
Tibia	0	0	0	0	2	0	0
Patella	0	0	0	0	2	0	0
Upper hind limbs	**1**	**1**	**1**	**1**	**6**	**0.16**	7.2
Metacarpal III	5	4	2	2	2	1	45
Vestigial (MCII + MCIV)	0	0	0	0	4	0	0
carpals	0	0	0	0	14	0	0
sesmoids	0	0	0	0	4	0	0

Lower front limbs	**5**	**4**	**2**	**2**	**24**	**0.08**	4
Metatarsal III	5	4	2	1	2	1	45
Vestigial (MTII + MTIV)	0	0	0	0	4	0	0
Tarsals	33	31	26	11	12	2.2 (max)	100
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**38**	**35**	**27**	**11**	**22**	**1.12**	51
1st phalanx	11	10	7	-	4	1.75	80
2nd phalanx	4	3	3	-	4	0.75	34
3rd phalanx	2	2	2	-	4	0.5	23
Sesmoids	0	0	0	0	4	0	0
Extremities	**17**	**15**	**12**	**0**	**16**	**0.75**	34
Vertebrae	3	3	3	1	31	0.09	4
Ribs	0	0	0	0	36	0	0
Pelvis	6	5	3	2	2	1.5	68
Axial skeleton	**9**	**8**	**6**	**2**	**69**	**0.09**	4
Isolated Upper Adult Teeth	7	6	7	1	20	0.35	16
Isolated Upper Deciduous Teeth	1	1	1	1	12	0.08	4
Isolated Lower Adult Teeth	15	13	13	5	20	0.65	25
Isolated Lower Deciduous Teeth	1	1	1	1	12	0.08	4
Mandibles	0	0	0	0	1	0	0
Cranial Bones	2	2	1	1	4	0.25	11
Cranial skeleton	**26**	**23**	**23**	**5A;2J**	**45A;29J**	**0.47A;0.07J**	**21A;3J**

Total MNI=13; 11 Adults, 2 Juveniles

Level II/7

Element	**NISP**	**%NISP**	**MNE**	**MNI**	**Qsp**	**MAU**	**%MAU**
Scapula	2	2	1	1	2	0.6	24
Humerus	0	0	0	0	2	0	0
Radius/ulna	5	6	5	3	2	2.5(max)	100
Upper front limbs	**7**	**8**	**6**	**3**	**6**	**1**	**0.4**

Femur	0	0	0	0	2	0	0
Tibia	0	0	0	0	2	0	0
Patella	0	0	0	0	2	0	0
Upper hind limbs	**0**	**0**	**0**	**0**	**6**	**0**	**0**
Metacarpal III	7	8	2	1	2	1	40
Vestigial (MCII + MCIV)	2	2	2	1	4	0.5	20
carpals	2	2	2	1	14	0.14	5.6
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**11**	**12**	**6**	**1**	**24**	**0.25**	**10**
Metatarsal III	6	8	2	1	2	1	40
Vestigial (MTII + MTIV)	1	1	1	1	4	0.25	10
Tarsals	9	11	8	3	12	0.67	27
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**16**	**20**	**11**	**3**	**22**	**0.46**	**18**
1st phalanx	6	8	6	2A;1J	4	1.5	60
2nd phalanx	5	6	4	-	4	1	40
3rd phalanx	0	0	0	0	4	0	0
Sesmoids	0	0	0	0	4	0	0
Extremities	**11**	**14**	**10**	**2A;1J**	**16**	**0.62**	**25**
Vertebrae	2	2	2	1	31	0.06	2.4
Ribs	0	0	0	0	36	0	0
Pelvis	11	12	4	2	2	2	80
Axial skeleton	**13**	**14**	**6**	**2**	**69**	**0.09**	**3.6**
Isolated Upper Adult Teeth	6	8	5	2	20	0.25	10
Isolated Upper Deciduous Teeth	0	0	0	0	12	0	0
Isolated Lower Adult Teeth	21	24	19	1	20	0.95	38
Isolated Lower Deciduous Teeth	0	0	0	2	12	0	0
Cranium	1	1	1	1	1	1	40
Mandible	0	0	0	0	4	0	0
Cranial skeleton	**28**	**33**	**25**	**3A**	**45A;29J**	**0.55A**	**0.22**

Total MNI=4; 3 Adults, 1 Juvenile

Level II/8

Element	NISP	%NISP	MNE	MNI	Qsp	MAU	%MAU
Scapula	13	2	11	6	2	5.5	48
Humerus	36	7	12	7	2	6	52
Radius/ulna	34	7	9	6	2	4.5	39
Upper front limbs	**83**	**17**	**32**	**7**	**6**	**5.3**	**46**
Femur	9	2	4	3	2	2	17
Tibia	28	5	11	6	2	5.5	48
Patella	0	0	0	0	2	0	0
Upper hind limbs	**37**	**7**	**15**	**6**	**6**	**2.5**	**22**
Metacarpal III	43	8	8	5	2	4	35
Vestigial (MCII + MCIV)	2	1	2	1	4	0.5	4
carpals	11	2	11	5	14	0.78	7
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**56**	**11**	**21**	**5**	**24**	**0.87**	**7**
Metatarsal III	56	11	11	6	2	5.5	48
Vestigial (MTII + MTIV)	5	1	5	2	4	1.25	11
Tarsals	59	11	31	6A;1Y	12	2.6	23
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**120**	**23**	**47**	**6A;1Y**	**22**	**2**	**0.17**
1st phalanx	78	15	46	6	4	11.5 (max)	100
2nd phalanx	20	4	13	-	4	3.25	28
3rd phalanx	18	3	14	-	4	0.28	2
Sesmoids	2	1	2	1	4	0.5	4
Extremities	**118**	**23**	**75**	**6**	**16**	**4.7**	**41**
Vertebrae	29	5	19	3	31	0.61	5
Ribs	0	0	0	0	36	0	0
Pelvis	9	2	4	3	2	0	0
Axial skeleton	**38**	**7**	**23**	**3**	**69**	**0.33**	**3**

Isolated Upper Adult Teeth	8	1	8	2	20	0.4	3
Isolated Upper Deciduous Teeth	1	1	1	1	12	0.08	1
Isolated Lower Adult Teeth	30	6	30	4	20	1.5	13
Isolated Lower Deciduous Teeth	2	1	2	1	12	0.17	1
Cranium	6	1	3	3	1	3	26
Mandible	14	3	3	2	4	0.75	6
Cranial skeleton	**61**	**12**	**47**	**2A;2J**	**45A;29J**	**0.98A;0.83J**	**8A;7J**

Total MNI=10; 7 Adults, 2 Juvenile, 1 Yearling

Level II/9

Element	**NISP**	**%NISP**	**MNE**	**MNI**	**Qsp**	**MAU**	**%MAU**
Scapula	4	7	3	2	2	1.5 (max)	100
Humerus	0	0	0	0	2	0	0
Radius/ulna	6	11	2	2	2	1	67
Upper front limbs	**10**	**16**	**5**	**2**	**6**	**0.83**	**55**
Femur	2	4	1	1	2	0.5	33
Tibia	0	0	0	0	2	0	0
Patella	0	0	0	0	2	0	0
Upper hind limbs	**2**	**4**	**1**	**1**	**6**	**0.17**	**11**
Metacarpal III	1	2	1	1	2	0.5	33
Vestigial (MCII + MCIV)	0	0	0	0	4	0	0
carpals	0	0	0	0	14	0	0
sesmoids	0	0	0	0	4	0	0
Lower front limbs	**1**	**2**	**1**	**1**	**24**	**0.04**	**3**
Metatarsal III	1	2	1	1	2	0.5	33
Vestigial (MTII + MTIV)	0	0	0	0	4	0	0
Tarsals	0	0	0	0	12	0	0
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**1**	**2**	**1**	**1**	**22**	**0.05**	**3**
1st phalanx	1	2	1	1	4	0.25	17

2nd phalanx	1	2	1	1	4	0.25	17
3rd phalanx	0	0	0	0	4	0	0
Sesmoids	0	0	0	0	4	0	0
Extremities	**2**	**4**	**2**	**1**	**16**	**0.12**	**8**
Vertebrae	5	9	4	2	31	0.13	9
Ribs	0	0	0	0	36	0	0
Pelvis	14	26	4	2	2	1.5	100
Axial skeleton	**19**	**35**	**8**	**2**	**69**	**0.11**	**7.3**
Isolated Upper Adult Teeth	4	7	4	1S	20	0.2	13
Isolated Upper Deciduous Teeth	9	17	8	2	12	0.67	45
Isolated Lower Adult Teeth	2	4	2	1A	20	0.1	7
Isolated Lower Deciduous Teeth	2	4	2	1	12	0.17	11
Cranium	0	0	0	0	1	0	0
Mandible	1	2	1	1	4	0.25	17
Cranial skeleton	**18**	**34**	**17**	**1A;1S;2 J**	**45A;29J**	**0.11A;0.34 J**	**7A;23J**

Total MNI=4; 1 Adult, 1 Senile, 2 Juveniles

Level II/13

Element	NISP	%NISP	MNE	MNI	Qsp	MAU	%MAU
Scapula	3	2	2	2	2	1	33
Humerus	5	3	2	1	2	1	33
Radius/ulna	8	6	4	3A;1Y	2	2	67
Upper front limbs	**16**	**11**	**8**	**3A;1Y**	**6**	**1.3**	**43**
Femur	2	1	2	1A;1Y	2	1	33
Tibia	6	5	4	3	2	2	67
Patella	0	0	0	0	2	0	0
Upper hind limbs	**8**	**6**	**6**	**3A;1Y**	**6**	**1**	**33**
Metacarpal III	11	9	3	2	2	1.5	50
Vestigial (MCII + MCIV)	0	0	0	0	4	0	0
carpals	0	0	0	0	14	0	0
sesmoids	0	0	0	0	4	0	0

Lower front limbs	**11**	**9**	**3**	**2**	**24**	**0.12**	**4**
Metatarsal III	16	11	6	4	2	3 (max)	100
Vestigial (MTII + MTIV)	2	1	2	1	4	0.5	17
Tarsals	24	17	17	4	12	1.7	63
sesmoids	0	0	0	0	4	0	0
Lower hind limbs	**42**	**29**	**25**	**4**	**22**	**1.14**	**42**
1st phalanx	9	6	9	3	4	2.25	75
2nd phalanx	6	4	6	-	4	1.5	50
3rd phalanx	0	0	0	-	4	0	0
Sesmoids	0	0	0	-	4	0	0
Extremities	**15**	**11**	**15**	**3**	**16**	**0.93**	**31**
Vertebrae	5	3	3	1	31	0.09	3
Ribs	0	0	0	0	36	0	0
Pelvis	8	6	3	2	2	1.5	50
Axial skeleton	**13**	**9**	**6**	**2**	**69**	**0.08**	**3**
Isolated Upper Adult Teeth	14	10	12	4	20	0.6	20
Isolated Upper Deciduous Teeth	4	3	4	2	12	0.33	11
Isolated Lower Adult Teeth	13	9	12	4	20	0.6	20
Isolated Lower Deciduous Teeth	0	0	0	0	12	0	0
Cranium	4	3	1	1	1	1	33
Mandible	0	0	0	0	4	0	0
Cranial skeleton	**35**	**25**	**29**	**4A;2J**	**45A;29J**	**0.55A;0.14J**	**18A;5J**

Total MNI=7; 4 Adults, 1 Yearling, 2 Juveniles

Appendix D-Raw Figures for the Remains of other Species

Level II/1

Cervus elaphus

	Element	NISP	MNE	MNI	Comments
Upper Front Limbs	Humerus	1	1	1	
Lower Front Limbs	Metacarpal	1	1	1	
Extremities	2nd phalanx	1	1	1	
				Total MNI=1	

Level II/2-1

Saiga tatarica

	Element	NISP	MNE	MNI	Comments
Cranial Skeleton	Mandible	1	1	1	
				Total MNI=1	

Bos sp.

	Element	NISP	MNE	MNI	Comments
Cranial Skeleton	Isolated Teeth	2	2	1	
				Total MNI=1	

Capra ibex

	Element	NISP	MNE	MNI	Comments
Upper Hind Limbs	Femur	1	1	1	
				Total MNI=1	

Level II/3

Cervus elaphus

	Element	NISP	MNE	MNI	Comments
Lower Front Limbs	Metacarpal	2	1	1	
				Total MNI=1	

Sus sp.

	Element	NISP	MNE	MNI	Comments
Cranial Skeleton	Isolated Teeth	1	1	1	
				Total MNI=1	

Level II/5

Cervus elaphus

	Element	NISP	MNE	MNI	Comments
Lower Front Limbs	Metacarpal	1	1	1	
				Total MNI=1	

Saiga tatarica

	Element	NISP	MNE	MNI	Comments
Upper Front Limbs	Radius/Ulna	1	1	1	
Lower Front Limbs	Metacarpal	1	1	1	
				Total MNI=1	

Level II/7

Saiga tatarica

	Element	NISP	MNE	MNI	Comments
Upper Front Limbs	Humerus	6	2	1	
Lower Hind Limbs	Metatarsal	1	1	1	
Axial Skeleton	Pelvis	1	1	1	
				Total MNI=1	

Marmota sp.

	Element	NISP	MNE	MNI	Comments
Cranial Skeleton	Isolated Teeth	1	1	1	
				Total MNI=1	

Level II/8

Cervus elaphus

	Element	NISP	MNE	MNI	Comments
Upper Front Limbs	Radius/Ulna	1	1	1	
Lower Front Limbs	Metacarpal	1	1	1	
Lower Hind Limbs	Metatarsal	3	1	1	
				Total MNI=1	

Bos sp.

	Element	NISP	MNE	MNI	Comments
Lower Hind Limbs	Tibia	1	1	1	
	Metatarsal	1	1	1	
				Total MNI=1	

Crocuta crocuta

	Element	NISP	MNE	MNI	Comments
Cranial Skeleton	Isolated Teeth	1	1	1	
				Total MNI=1	

Level II/13

Cervus Elaphus

	Element	NISP	MNE	MNI	Comments
Lower Hind Limbs	Metatarsal	1	1	1	
	Calcaneus	1	1	1	
Cranial Skeleton	Isolated Teeth	1	1	1	very worn
				Total MNI=1	

Saiga tatarica

	Element	NISP	MNE	MNI	Comments
Axial Skeleton	Pelvis	1	1	1	
				Total MNI=1	

Level II/13A

Bos sp.

	Element	NISP	MNE	MNI	Comments
Upper Front Limbs	Scapula	1	1	1	
Lower Hind Limbs	Tibia	1	1	1	
	Metatarsal	2	1	1	
	Astralagus	1	1	1	
Axial Skeleton	Pelvis	2	1	1	
				Total MNI=1	

Appendix E-Averaged Mineral Density Values for Equid Bones (After Lam et al.1999)

Element	Density (g/cm3)
Proximal Humerus	0.23
Caudal Vertebrae	0.3
Hyoid	0.31
Proximal Femur	0.33
Sacrum	0.36
Distal Humerus	0.36
Proximal Tibia	0.37
Distal Femur	0.38
Thoracic Vertebrae	0.4
Cervical Vertebrae 3-7	0.41
Pubic Symphysis	0.42
Distal Radius/Ulna	0.42
Pubis	0.44
Proximal Radius/Ulna	0.44
Corpus calcanei	0.45
Lumbar Vertebrae	0.46
Ribs	0.46
Distal Tibia	0.5
Cuboid	0.5
Axis	0.53
Atlas	0.54
Proximal 1st Phalanx	0.57
3rd Phalanx	0.57
Lunate	0.57
Intermediate Mandible	0.58
Intermediate Femur	0.59
Distal 2ndPhalanx	0.59
Distal Metatarsal	0.59
Fibula	0.59
Intermediate Humerus	0.6
Proximal Metacarpal	0.6
Cuneiform	0.6
Scaphoid	0.62
Distal Metacarpal	0.62
Sustentaculum Tali	0.62
Proximal 2nd Phalanx	0.62
Capitate	0.62
Scapula	0.64
Ramus	0.64
MCII	0.64
Acetabulum	0.65

Astralagus	0.66
Proximal Metatarsal	0.67
Intermediate 1st Phalanx	0.67
Distal 1st Phalanx	0.67
Incisial Platform	0.68
Ilium	0.69
Navicular	0.71
Process Anterior	0.72
MCIV	0.74
Intermediate Metatarsal	0.81
Intermediate Tibia	0.82
Ischium	0.83
MTIV	0.83
Intermediate Radius/Ulna	0.84
Intermediate Metacarpal	0.84
MTII	0.87
Mandibular hinge	0.91
Petrous Bones	1.25

Appendix F-Utility Values for Equid Bones (After Outram & Rowley-Conwy 1998)

Standard Food Utility Index (SFUI)

Element	(S)FUI
Skull	17.9
Mandible	7.4
Atlas	7.8
Axis	7.8
Cervicals 3-7	45.2
Thorax	100
Lumbar	22.4
Pelvis	53
Scapula	15
Proximal Humerus	15
Distal Humerus	14.1
Proximal Radius/Ulna	8.7
Distal Radius	6
Proximal Metacarpal	1.6
Distal Metacarpal	0.7
Carpals	3.1
Proximal Femur	45.4
Distal Femur	45.4
Proximal Tibia	25.3
Distal Tibia	15.2
Proximal Metatarsal	3.8
Distal metatarsal	1.8
Tarsals	7.6
1st phalanx	0.9
2nd phalanx	0.9
3rd phalanx	0.9

Meat Weight Indices

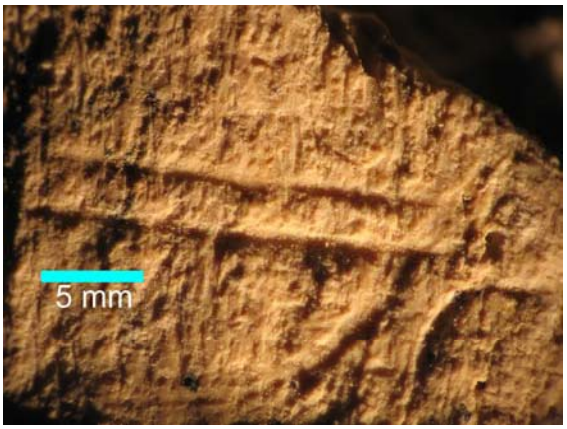
Element	Meat Index
Skull	18.3
Mandible	7.3
Atlas	7.6
Axis	7.6
Cervicals 3-7	45.2
Thorax	100
Lumbar	21.8
Pelvis	53.7
Scapula	15.2
Humerus	12.3
Radius/ulna	3.6
Metacarpal III	0
Carpals	0
Femur	44.5
Tibia	5.1
Metatarsal III	0
Tarsals	0
1st phalanx	0
2nd phalanx	0
3rd phalanx	0

Marrow Weight Indices

Element	Marrow Index
Skull	0
Mandible	49.9
Atlas	0
Axis	0
Cervicals 3-7	0
Thorax	0
Lumbar	0
Pelvis	0
Scapula	0
Humerus	56.5
Radius/ulna	33.7
Metacarpal III	15.7
Carpals	0
Femur	100
Tibia	46.2
Metatarsal III	13.1
Tarsals	0
1st phalanx	1.4
2nd phalanx	0
3rd phalanx	0

Appendix G-Photographs

Image 1- The visual differences between a) ancient cut marks and b) modern cut marks resulting from excavation damage. Note the lack in differential color and absence of weathering in the inner surfaces of b).



a)

b)

Image 2- An *Equus hydruntinus* femur displaying 1) a spiral fracture at its mid-diaphysis and 2) a flake scar in association with the spiral fracture.

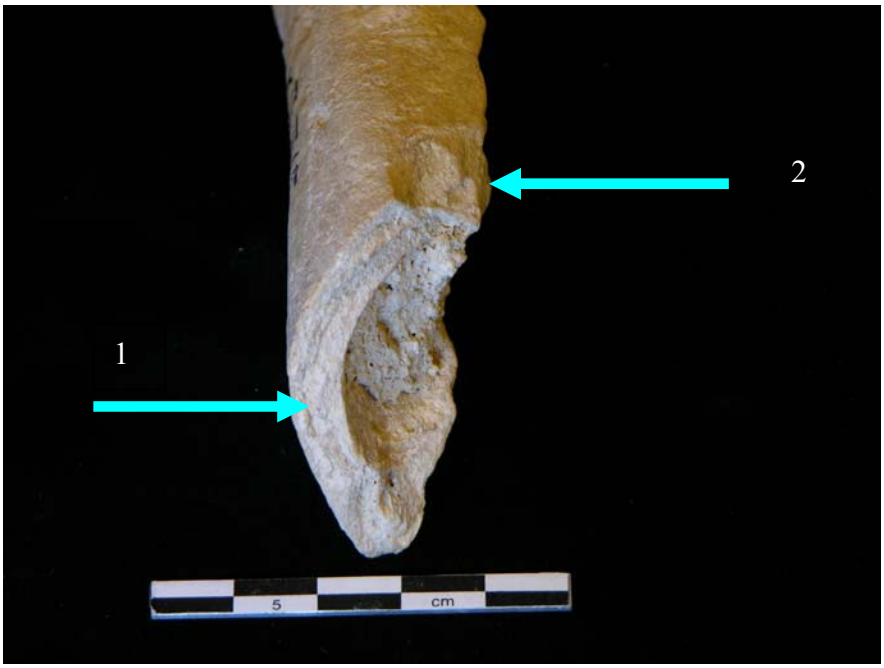


Image 3- A fragment of an *Equus hydruntinus* scapula depicting the type of manganese oxide staining found on the bones at Kabazi II.

Image 4-Fragment of a hyena upper 4th incisor from Level II/8

Image 5- Fossil shark tooth found in Level II/7A